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RUMMEL KELEPPER AND KAHL BALTIMORE MD
NATIONAL DAM INSPECTION PROGRAM, ST. MARY'S RIVER WATERSHED, SI--ETC(U)
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MARYLAND

ST. MARY'S RIVER WATERSHED
SITE NO. 1

NBI JB NO. MD-28
STATE OF MARYLAND

LEVEL

DEPARTMENT OF NATURAL RESOURCES

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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Project for
DEPARTMENT OF THE ARMY
District Engineer, Corps of Engineers
Baltimore District, Maryland 21203

490031-80-C-0050

CONTRACT NO. A-4411
CONTRACT DATE 1978

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⑩ Edward J. Zeigler

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POTOMAC RIVER BASIN,

WESTERN BRANCH OF ST. MARY'S RIVER, ST. MARY'S COUNTY,

MARYLAND,

② National Dam Inspection Program

ST. MARY'S RIVER WATERSHED, SITE 1,

(NDI-ID MD-28)

Number

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES,

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

⑪ Jul 84

⑮ DHCW 31-80-C-0050

⑫ 76

Prepared for:
DEPARTMENT OF THE ARMY
Baltimore District Corps of Engineers
Baltimore, Maryland 21203

By:
RUMMEL, KLEPPER & KAHL
Consulting Engineers
1035 N. Calvert Street
Baltimore, Maryland 21202

July 1980

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Department of the Army, Office of Chief of Engineers, Washington, D.C. 20314.

The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon visual observations and review of available data. Detailed investigations and analyses involving topographic mapping, subsurface investigations, material testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the inspection is intended to identify any need for such studies which should be performed by the owner.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of the dam depends on numerous and constantly changing internal and external factors which are evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The assessment of the conditions and recommendations was made by the consulting engineer in accordance with generally and currently accepted engineering principles and practices.

POTOMAC RIVER BASIN
 WESTERN BRANCH OF ST. MARY'S RIVER, ST. MARY'S COUNTY
 MARYLAND

ST. MARY'S RIVER WATERSHED, SITE NO. 1
 NDI ID NO. MD-28

STATE OF MARYLAND
 DEPARTMENT OF NATURAL RESOURCES

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

July 1980

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION
AND RECOMMENDED ACTION

Name of Dam: St. Mary's River Watershed, Site No. 1
NDI ID NO. MD-28
Size: Intermediate (9600 acre-feet, 38 feet high)
Hazard Classification: High
Owner: State of Maryland
Department of Natural Resources
Tawes State Office Building
Annapolis, Maryland
State Located: Maryland
County Located: St. Mary's
Stream: Western Branch of St. Mary's River
Dates of Inspection: July 1, 1980 and August 5, 1980

Based on the visual inspection, available records, past operational performance, and in accordance with the guideline criteria established for these studies, St. Mary's River Watershed, Site No. 1 is judged to be in fair condition.

The water level in St. Mary's River Watershed, Site No. 1 is maintained at approximately elevation +61, the crest elevation of the principal spillway riser pipe. The water level can also be controlled by opening either one of the two manually operated 24 inch by 48 inch sluice gates located near the top of the principal spillway chamber, or the manually operated 36 inch sluice gate located at the base of the chamber. Between the upper and lower sluice gates in the riser chamber is a 3 inch globe valve that is normally open for maintenance of low flow releases. Water is conveyed through the embankment in a 36 inch diameter concrete conduit and is discharged into a stilling basin which empties into the Western Branch of the St. Mary's River. A 300 foot wide emergency spillway is excavated adjacent to the right abutment of the dam. Based on the dam crest survey, the freeboard at the time of inspection was 16 feet.

Numerous erosion gullies were noted on the embankment, particularly on the downstream slope. The longest gullies were approximately 3 feet wide, 1 foot deep, and 20 feet long. Vegetative cover on the slopes is primarily grass and crown vetch, but coverage is sparse at many locations on the downstream slope. Trails have been blazed on both the upstream and downstream slopes, and on the crest of the embankment, by motor bikes and recreational vehicles resulting in less vegetative cover. Numerous depressions, the largest being 6 inches deep and measuring 8 feet by 8 feet in plan dimensions, were noted on the crest of the embankment, apparently the consequence of the recreational vehicle traffic. A small amount of erosion was noted along the right side of the stilling basin where the stone riprap slope protection has been displaced.

St. Mary's River Watershed , Site No. 1
NDI ID NO. MD-28

According to the hydrologic and hydraulic analyses, the St. Mary's River Watershed, Site No. 1 dam will pass 100 percent of the Probable Maximum Flood without overtopping, and therefore its spillway is rated adequate.

The following remedial measures are recommended to be accomplished by the Owner:

1. Repair all erosion gullies on the embankment and stabilize the repaired areas with grass.
2. Seed all areas of sparse vegetation, including the trails on the upstream and downstream slopes, and fertilize and re-seed as required to establish a stand of grass.
3. Repair the erosion along the right side of the stilling basin and replace the riprap slope protection.
4. Develop a formal warning system to alert downstream residents in the event of emergencies.
5. Conduct regularly scheduled maintenance of the embankment and appurtenant structures.
6. Control the growth of woody vegetation on the embankment slopes.

Submitted by:

RUMMEL, KLEPPER & KAHL



Edward J. Zeigler
Edward J. Zeigler, P.E.
Associate

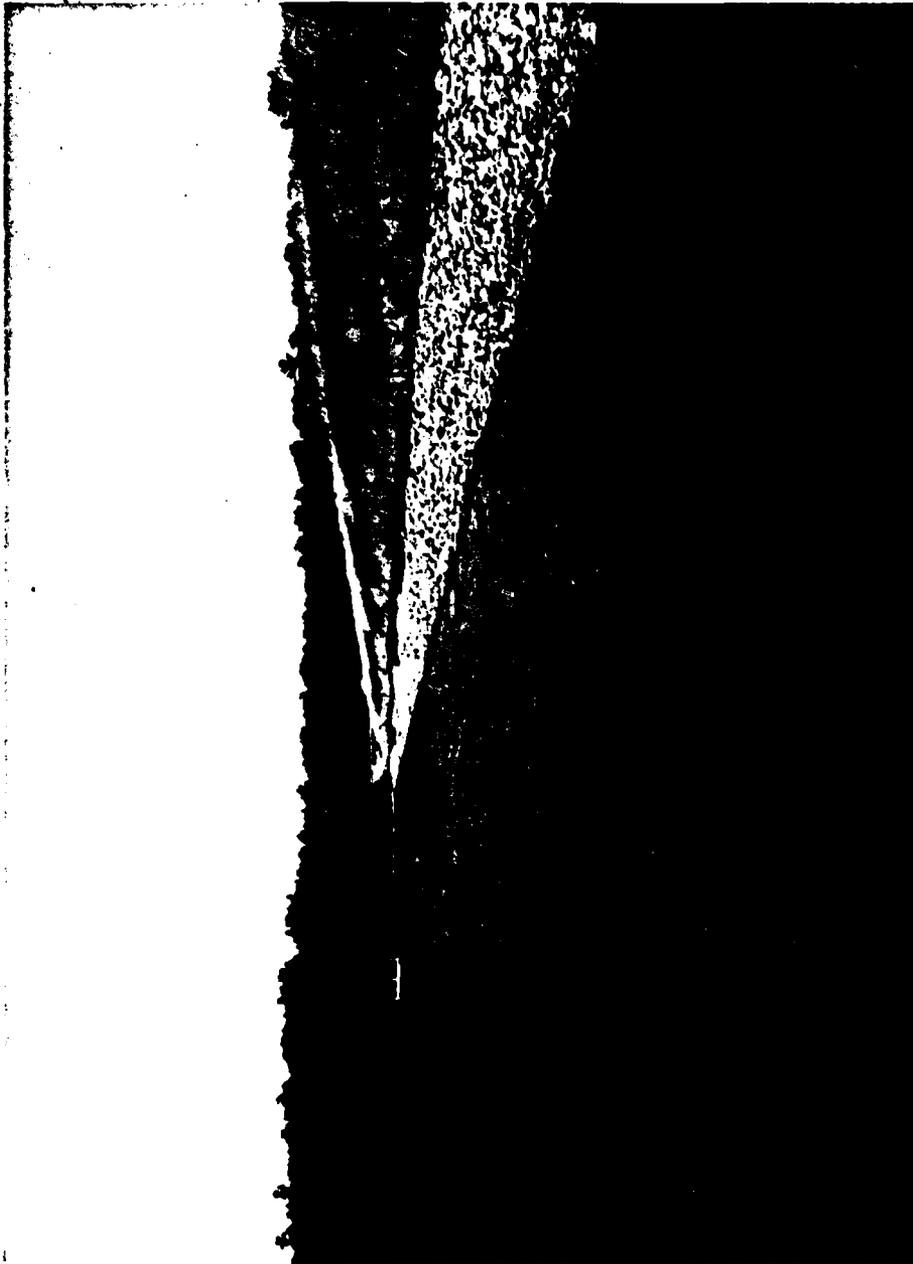
Date: *August 28, 1980*

Approved by:

James W. Peck
JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: *18 Sep 80*

ST. MARY'S RIVER WATERSHED, SITE NO. 1



Upstream face of the dam

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

ST. MARY'S RIVER WATERSHED, SITE NO. 1
NDI ID NO. MD-28

SECTION 1
PROJECT INFORMATION

1.1 General.

- a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.
- b. Purpose. The purpose of the dam inspection program is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

- a. Dam and Apurtenances. St. Mary's River Watershed, Site No. 1, completed in 1975, is a zoned earth fill embankment with an impervious core, a cutoff trench, and a toe drain. The embankment is 38 feet high at its maximum section and is approximately 1670 feet long. The dam is constructed across the Western Branch of the St. Mary's River.

Inflow into the impoundment is from the Western Branch of the St. Mary's River, from precipitation falling directly on the lake, and from surface runoff.

The flood discharge facilities for the dam consist of the principal spillway comprised of a drop inlet spillway and two manually operated sluice gates located in the spillway riser structure, and a 300 foot wide emergency spillway located adjacent of the right abutment of the dam. From the spillway riser, water is conveyed through the embankment by a 36 inch diameter concrete conduit and is discharged into a stilling basin which empties into the Western Branch of St. Mary's River. The normal pool elevation of +61 for the lake corresponds to the crest elevation of the principal spillway riser. The lake can be lowered below the normal pool elevation by opening any of the two intermediate sluice gates and/or the lower drain sluice gate.

- b. Location. The dam is on the Western Branch of the St. Mary's River, approximately 1.4 miles upstream from its confluence with St. Mary's River in St. Mary's County, Maryland. St. Mary's River Watershed, Site No. 1 is shown on U.S.G.S. Quadrangle, Hollywood, Maryland, at latitude N 38° 15' 6" and longitude W 76° 32' 6". A location map is included as Plate E-1.
- c. Size Classification. Intermediate (38 feet high, 9600 acre-feet).
- d. Hazard Classification. High hazard. There are residences and businesses along St. Mary's River downstream of the dam which could be damaged in a flood resulting from a dam failure.
- e. Ownership. State of Maryland, Department of Natural Resources, Tawes State Office Building, Annapolis, Maryland.
- f. Purpose of Dam. Flood control and fish and wildlife resource improvement.
- g. Design and Construction History. The dam, completed in 1975, was built under the Watershed Protection and Flood Prevention Act by the County Commissioners of St. Mary's County; the St. Mary's County Soil Conservation District; and the State of Maryland Board of Public Works, Department of Natural Resources. Design assistance was provided by the Soil Conservation Service of the U.S. Department of Agriculture. The dam was constructed by the Pleasant Excavating Company. According to the typical section of the embankment shown on the as-built drawings of the dam provided by the State of Maryland Water Resources Administration, the zoned earth fill dam has an impermeable core, a cutoff trench, and a toe drain.
- h. Normal Operating Procedure. As it presently exists, the lake is maintained at or near the crest elevation of the principal spillway, approximately elevation +61.0.

1.3 Pertinent Data

- a. Drainage Area. 8.76 square miles
- b. Discharge at Dam Site. 21,000 cfs outflow at Elevation 77.15
- c. Elevation.

Top of Dam	77.1 (design)
	77.15 (low point on crest)
Maximum Pool	71.3 (design flood level)
Normal Pool	61.0 (spillway crest)
Upstream Invert Outlet Works	40
Downstream Invert Outlet Works	39
Maximum Tailwater	Unknown
Downstream Toe	39

d. Reservoir Length.

Normal Pool Level	7500+ feet
Maximum Pool Level	11400+ feet

e. Storage (Acre-Feet).

Normal Pool Level	3200
Maximum Pool Level	6500
Top of Dam	9600

f. Reservoir Surface (Acres).

Normal Pool	250
Maximum Pool	420
Top of Dam	500

g. Dam.

Type:	Earthfill
Length:	1670+'
Height:	38' maximum
Top Width:	16'
Volume of Fill:	245,309 cu. yds.
Side Slopes:	Upstream and Downstream: 1V:3H
Zoning:	Four different zones
Impervious Core:	Comprised of CH* fill
Cutoff:	Comprised of SC* fill
Grout Curtain:	None

*as defined by the Unified Soil Classification System

h. Outlet Works.

Type	Free-flow conduit
Pipe Size and Material	36" reinforced concrete pipe
Entrance Invert	Elev. 40
Exit Invert	Elev. 39
Type and Number of Gates	One, 36 inch diameter sluice gate
Type of Energy Dissipator	Stilling Basin

i. Principal Spillway.

Type	Drop inlet spillway
Crest Elevation	Elev. 61
Crest Length	18 Feet
Number and Type of Gates	Two, 24 inch by 48 inch sluice gates at invert elevation 53.5, and one 3-inch globe valve at invert elevation 50.4

j. Emergency Spillway.

Type:	Open Channel Spillway
Location:	Adjacent to right dam abutment
Crest Elevation:	69.5
Crest Width:	300+ feet
Inlet Channel Length:	400+ feet at 1%
Exit Channel Length:	200+ feet at 2%

SECTION 2
DESIGN DATA

2.1. Design.

a. Data Available. The available information was provided by the State of Maryland, Water Resources Administration. The information includes as-built drawings of the dam, the 1972 "Design Report for the St. Mary's River Watershed, St. Mary's County, Maryland, Site 1" prepared by the U.S. Department of Agriculture, Soil Conservation Service, and a file containing some pertinent correspondence.

(1) Hydrology and Hydraulics. Hydrologic and hydraulic calculations for the dam are included in the Design Report.

(2) Embankment. Design calculations are included in the Design Report, and fill compaction requirements and the results of the subsurface investigations are shown on the as-built drawings.

(3) Appurtenant Structure. Design data is included in the Design Report and structural details are shown on the as-built drawings.

b. Design Features.

(1) Embankment and Emergency Spillway. The dam is constructed across the Western Branch of the St. Mary's River. Earth fill for the embankment was obtained from excavation for the emergency spillway and cutoff trench, and from a borrow area adjacent to the left abutment of the dam. An extensive subsurface investigation, including test borings and test pits, was conducted to study foundation conditions of the dam and to locate borrow sources.

The as-built drawings indicate that the dam is a zoned embankment consisting of a center core of compacted impermeable fill. Constructed beneath this core is a cutoff trench, also comprised of impermeable fill.

A toe drain is constructed along the full length of the embankment at the downstream end of the impermeable core. Stone riprap slope protection is constructed on the upstream slope from elevation +50 up to elevation +65. The slope protection is keyed into an 18 foot wide berm near the toe of the upstream slope. The dam is approximately 1670 feet long and 38 feet high at its maximum section. A typical section of the dam is shown on copies of the As-Built drawings included in Appendix E.

The emergency spillway was excavated adjacent to the right abutment of the dam and is 300 feet wide along its crest. The 30 foot wide level section of the emergency spillway parallels the dam crest. The upstream spillway channel has a 1% grade and the downstream spillway channel has a 2% grade.

- (2) Appurtenant Structures. The appurtenant structures of the dam consist of the principal spillway which includes riser pipe inlet and the outlet works. Two, 24 inch by 48 inch sluice gates are located near the top of the riser pipe chamber, and a 36 inch sluice gate is located near the bottom. The riser discharges into a 36 inch concrete conduit which conveys the water through the embankment into a riprap protected stilling basin. According to the as-built drawings, the 275+ foot long concrete conduit has eight anti-seep collars. The water level in the lake can be lowered by manually opening either of the upper two sluice gates, or the lower sluice gate located in the intake chamber. The sluice gate stem extensions and handwheels are located on top of the riser deck. Between the upper and lower sluice gates in the riser chamber is a 3 inch globe valve that is normally open for maintenance of low flow releases.

c. Design Data.

- (1) Hydrology and Hydraulics. Design data are included in the Design Report.

- (2) Embankment. Design data are included in the Design Report and on the as-built drawings.

2.2 Construction. Construction of the dam was completed in November 1975, but it was not until 1979 that the sluice gates were closed completely so that the lake could rise to its normal pool elevation. The only available records of construction are the as-built drawings.

2.3 Operation. No records are kept of the operation of the dam or appurtenant structures.

2.4 Other Investigations.

Records are available of two inspections which were made of the dam since completion. A Maryland Water Resources Investigator inspected the dam on April 16, 1976 and recommended that woody vegetation on the slopes be removed. Mr. J. P. Plocek of the Maryland Department of Natural Resources inspected the dam on July 2, 1979, and recommended that areas of sparse vegetation be seeded.

2.5 Evaluation.

- a. Availability. The Design Report, the as-built drawings, and a file of pertinent correspondence regarding the dam are available.
- b. Adequacy. The available data is considered sufficient to evaluate the design and construction of the dam.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The on site inspection of St. Mary's River Watershed, Site No. 1 consisted of:

- (1) Visual inspection of the embankment, abutments, and embankment toe.
- (2) Visual examination of the appurtenant structures.
- (3) Evaluation of the downstream area hazard potential.

The specific observations are shown on Plate A-1.

b. Embankment. The general inspection of the embankment consisted of searching for indications of structural distress, such as cracks, subsidence, bulging, wet areas, seeps and boils, and observing general maintenance conditions, vegetative cover, erosion, and other surficial features. Numerous erosion gullies were noted on the embankment, particularly on the downstream slope. The largest gullies were noted on the downstream slope immediately right of the 36 inch outlet conduit, and were a maximum of 3 feet wide, 1 foot deep, and 20 feet long.

The vegetative cover on the slopes is primarily grass and crown vetch, but coverage is sparse in many locations, particularly on the downstream slope. A few small trees and woody vegetation were noted on both the upstream and downstream slopes. Portions of both the upstream and downstream embankment have been denuded by trails blazed by motor bikes and other recreational vehicles. Recreational vehicle traffic is also the probable cause of the numerous small depressions noted across the crest of the dam. The largest depression noted was 6 inches deep and measured 8 feet by 8 feet in plan dimensions.

The crest of the dam was surveyed and the variance in elevation was 10.5 inches between the high and low point. Also, the low point on the crest is 0.6 inches above the design dam crest elevation of 77.1 feet above m.s.l. It should be noted that the crest elevations were referenced to a pin set by the U.S. Soil Conservation Service in a tree along the right abutment of the dam. Freeboard at the time of inspection was approximately 16 feet, and under design maximum pool conditions would be approximately 5.9 feet. The dam crest profile is included on Plate A-2.

- c. Appurtenant Structures. The appurtenant structures were found to be in good condition. According to the State of Maryland Park Ranger who periodically checks the facility, the three sluice gates are checked once a year to confirm that they are functioning properly. Normally in December, representatives of the State of Maryland Fisheries Administration open the two upper sluice gates to lower the lake level so as to maintain storage at one half the design capacity for fish management.
- d. Reservoir Area. The stone riprap slope protection is adequately preventing erosion along the upstream slope of the embankment. With the exception of a several fishing peninsulas which extend into the lake, the banks of the reservoir are wooded up to the edge of the lake.
- e. Downstream Channel. The downstream channel is the Western Branch of the St. Mary's River. Outflow from the principal spillway flows into the Western Branch from a riprap protected stilling basin. Erosion was noted along the right side of the stilling basin where the riprap slope protection had been displaced. The confluence of Western Branch and St. Mary's River is approximately 1.4 miles downstream of the dam. One residence was noted along the St. Mary's River near Route 471. Further downstream from Route 471, in Great Mills, a motel, six residences, and some businesses are located along the St. Mary's River. Based on our observations, a high hazard classification is warranted for St. Mary's River Watershed, Site #1.

3.2 Evaluation. The visual examination and observations of St. Mary's River Watershed, Site No. 1 indicate that the embankment is in fair condition and the appurtenant structures are in good condition. We recommend that the erosion gullies on the slopes be repaired, and that grass be planted and maintained on all repaired and sparsely vegetated portions of the embankment. The small depressions noted along the crest of the dam are not large enough to require repairing. The erosion noted along the right side of the stilling basin should be repaired, and the stone riprap slope protection should be replaced.

SECTION 4
OPERATIONAL FEATURES

- 4.1 Procedure. There are no formal operating procedures for the dam. The lake level is normally maintained at or near the crest elevation of the principal spillway. During the winter, personnel of the Maryland Fisheries Administration of the Department of Natural Resources open the sluice gates to lower the water level in order to maintain storage at approximately one half the design capacity of the lake for fish and wildlife maintenance.
- 4.2 Maintenance of the Dam. In 1979, the responsibility for dam maintenance was shifted within the Department of Natural Resources from the Fisheries Administration to the State staff of Point Lookout State Park. Park rangers inspect the dam embankment regularly, but it is reported that a limited budget and limited equipment have made maintenance difficult. It is apparent that vegetation on the slopes has not been cut for a year and that no attempts have been made recently to repair the erosion gullies or to seed the areas of sparse vegetation.
- 4.3 Maintenance of Operating Facilities. The appurtenant structures appeared to be in satisfactory condition. According to the Head Ranger at Point Lookout State Park, all sluice gates are opened once a year to check if they function properly.
- 4.4 Warning System. No formal warning system exists for the dam. The dam is remote from any residences, so telephone communication facilities are not available.
- 4.5 Evaluation. The overall maintenance condition of the dam and its appurtenant structures is considered to be fair. It is recommended that scheduled maintenance, in addition to normal inspections, be undertaken on a regular basis by the Owner.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. The 1972 St. Mary's River Watershed Site 1 Design Report indicates that the reservoir's flood control storage capacity of 2600 acre-feet is based upon attenuating an inflow design flood having a peak of 2500 cubic feet per second (cfs) from a 100-year, 24-hour storm of 7.8 inches over the reservoir's 8.76 square mile area. The crest of the emergency spillway was established at the top of the flood control pool at a design elevation of 69.5 feet above mean sea level. The emergency spillway design flood was based upon a 6-hour storm of 11.5 inches having a peak reservoir inflow rate of 11,700 cfs. No storm frequency is assigned to the 11.5 inches of rainfall. Using the 11,700 cfs rate, the maximum design high water level was established at an elevation of 71.3 feet above mean sea level. The 1972 report employs a "freeboard hydrograph routing" for a probable maximum storm of 28 inches in 6 hours to establish the top of dam at a design elevation of 77.1 feet above mean sea level and the design freeboard at 5.8 feet

b. Experience Data. No records of maximum pool levels are available.

A U.S Geological Survey streamflow gaging station is maintained approximately 2.4 miles downstream from the dam. Streamflow records for this station indicate that the peak discharge of record occurred on August 20, 1969 (prior to construction of the dam) and equalled 7,950 cfs or 331 cfs per square mile based upon the 24.0 square mile gaging station drainage area.

c. Visual Observations. Several observations made during the visual inspection of St. Mary's River impoundment are particularly relevant to the hydraulic and hydrological evaluations.

(1) Embankment. The survey of the dam crest profile performed during the visual inspection indicates that the existing crest lies at or slightly above its design elevation of 77.1 feet above mean sea level with its low point at an elevation of 77.15 feet above m.s.l. The survey data for the existing crest was employed in subsequent hydraulic analysis.

(2) Emergency Spillway. The survey of the emergency spillway crest during the visual inspection indicates that the existing crest has a length of 300 feet and an elevation of 69.5 feet above mean sea level, as designed.

(3) Appurtenant Structures. The principal spillway (drop inlet spillway) and outlet works appear to have been constructed in accordance with record as-built drawings and functioning as designed.

(4) Downstream Conditions. Failure of the dam impounding the St. Mary's River Watershed Site 1 could cause significant damage to the community of Great Mills located slightly less than three miles downstream. At this location several single-family dwellings, a motel, and several other commercial establishments are located within or adjacent to the floodplain and are vulnerable to a dam failure event. The dwellings and motel house approximately 30 people. In addition, a dam failure event could overtop and damage State Routes 5 and 471 which serve the Great Mills community. In keeping with the potential hazard classification criteria established by the Office of the Chief of Engineers (OCE), the downstream conditions suggest that a high hazard classification be assigned to the St. Mary's River Watershed Site 1 impoundment.

d. Overtopping Potential. According to the criteria promulgated by the Office of the Chief of Engineers, the recommended Spillway Design Flood (SDF) for a dam classified as "intermediate" with a "high" hazard potential is 100 percent of the Probable Maximum Flood (PMF).

The Probable Maximum Precipitation (PMP) index as adjusted for the St. Mary's River Site 1 drainage area is 20.1 inches in 24 hours. Employing criteria established by the Corps of Engineers, Baltimore District, 100 percent and 50 percent PMF inflow hydrographs developed using the HEC-1 computer program have peaks of 20,600 and 10,300 cfs, respectively.

PMF inflow hydrographs were routed through St. Mary's River Site 1 for percentages ranging from 20 to 100 percent of the PMF with each routing starting at the normal pool elevation of 61 feet above m.s.l. For the 50 percent PMF routing, the reservoir water level reached an elevation of 72.4 feet above m.s.l. or 4.8 feet below the low point in the dam crest. For the 100 percent PMF routing, the reservoir water level reached an elevation of 76.1 feet above m.s.l. remaining below the dam crest low point of elevation 77.2 feet above m.s.l.

e. Spillway Adequacy. The St. Mary's River Site 1 reservoir will pass 100 percent of the PMF, the recommended Spillway Design Flood, without overtopping, and therefore its spillway capacity is rated adequate.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

- (1) Embankment. The most severe deficiencies noted in SECTION 3 were the numerous erosion gullies noted on both slopes of the embankment. However, at this time, none of the deficiencies is considered serious relative to the stability of the dam.
- (2) Appurtenant Structures. The structural conditions of the appurtenant structures is considered to be satisfactory.

b. Design and Construction Data.

- (1) Embankment. Based on the available design calculations and the as-built drawings, there are no conditions which adversely affect the stability of the dam.
- (2) Appurtenant Structures. The as-built drawings include the structural details of the appurtenant structures and are sufficient to assess the adequacy of the structures.

c. Operating Records. The structural stability of the dam is not considered to be affected adversely by the operational features of the dam.

d. Seismic Stability. The dam is located in Seismic Zone I. Based on our visual observations, the static stability of the dam appears to be adequate. Consequently, the structure should present no hazard from earthquakes.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

- a. Assessment. St. Mary's River Watershed Site No. 1 is an intermediate storage, high hazard impoundment. Failure of the dam embankment could cause significant damage to several single-family dwellings, a motel, and several other commercial establishments located slightly less than three miles downstream in the community of Great Mills. The visual observations indicate that the embankment of St. Mary's River Watershed, Site No. 1 is in fair condition, and the appurtenant structures are in good condition. At this time, the deficiencies noted in Section 3 do not seriously jeopardize the structural stability of the dam. If the deficiencies are left unattended, particularly the erosion gullies, an unstable condition could result.

Hydrologic and hydraulic analyses indicate that the St. Mary's River Watershed Site No. 1 reservoir will pass 100 percent of the PMF, the recommended Spillway Design Flood, without overtopping, and therefore its spillway capacity is rated adequate.

- b. Adequacy of Information. Available information, in conjunction with the visual observations, is considered to be sufficient to make the recommendations that are given below.
- c. Urgency. Although there is no urgency in instituting the remedial measures recommended below, the measures should be accomplished in a timely manner.
- d. Necessity for Additional Information. No additional information needed.

7.2 Recommendations/Remedial Measures

It is recommended that the following remedial measures be implemented by the Owner:

- a. Repair all erosion gullies on the embankment and stabilize the repaired areas with grass.
- b. Seed all areas of sparse vegetation, including the trails on the upstream and downstream slopes, and fertilize and re-seed as required to establish a stand of grass.
- c. Repair the erosion along the right side of the stilling basin and replace the riprap slope protection.

- d. Develop a formal warning system to alert downstream residents in the event of emergencies.
- e. Conduct regularly scheduled maintenance of the embankment and appurtenant structures.
- f. Control the growth of woody vegetation on the embankment slopes.

APPENDIX A

VISUAL INSPECTION CHECKLIST

PHASE I

APPENDIX A
VISUAL INSPECTION CHECKLIST
PHASE I

Name of Dam: St. Mary's River County (or City): St. Mary's State: Maryland
Name of Dam: Watershed, Site No. 1 County (or City): St. Mary's State: Maryland
NDI ID. No.: MD- 28 Type of Dam: Earth fill Hazard Category: High
Date(s) Inspection: 7/1/80 & 8/5/80 Weather: Clear Temperature: 90° F
Pool Elevation at Time of Inspection: 60'± above M.S.L. Tailwater at Time of Insp. 37'± above M.S.L.

Inspection Personnel:

Douglas Nauman
Jim Wise

Review Inspection Personnel:

Edward J. Zeigler
Frank H. Donaldson
Douglas Nauman
Douglas Nauman Recorder

VISUAL INSPECTION
 PHASE I
 EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Zones of erosion gullies and sparse vegetation on both slopes; particularly bad on downstream slope, right of outlet conduit *	Repair all erosion gullies; seed all repaired areas and areas of sparse vegetation and maintain stand of grass
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal alignment satisfactory; Vertical alignment varies 10.5 inches between high point and low point	Low point on dam crest is 0.6 inches above design crest elevation
RIPRAP FAILURES	None	*(OBSERVATIONS CONTINUED): Motor bike trails have denuded portions of embankment; few small trees noted on slopes.

VISUAL INSPECTION
 PHASE I
 EMBANKMENT

VISUAL EXAMINATION OF JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	None	
STAFF GAGE AND RECORDER	None	
DRAINS	Toe drains and outlet works of principal spillways all discharge into stilling basin	Seed area and maintain stand of grass

VISUAL INSPECTION
 PHASE I
 OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Satisfactory	
INTAKE STRUCTURE	Riser pipe	Riser pipe accessible only by boat
OUTLET STRUCTURE	36-inch diameter reinforced concrete pipe conveys water through embankment	
OUTLET CHANNEL	From the stilling basin, water flows into channel of Western Branch of St. Mary's River	
EMERGENCY GATE	Three sluice gates located in intake chamber; two upper and one lower; manually operated	All gates are checked by Owner at least once a year

VISUAL INSPECTION
 PHASE I
 UNGATED SPILLWAY - EMERGENCY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	None	
APPROACH CHANNEL	Spillway grass covered & excavated adjacent to right abutment. Spillway is 400±' wide at upstream end.	Spillway crest, along dam crest extended, is 300±' long. 1% grade from crest to upstream end.
DISCHARGE CHANNEL	Spillway narrows to 200±' at downstream end; 2% grade from crest to downstream end.	
BRIDGE AND PIERS	None	

VISUAL INSPECTION
 PHASE I
 GATED SPILLWAY - PRINCIPAL SPILLWAY

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	None	
APPROACH CHANNEL	Principal spillway comprised of reinforced concrete riser pipe and outlet works	
DISCHARGE CHANNEL	Outlet works is a 36-inch diameter reinforced concrete pipe which discharges into a stilling basin	
BRIDGE PIERS	None	
GATES AND OPERATION EQUIPMENT	Three manually operated sluice gates, 2 upper and 1 lower; a 3 inch globe valve, normally open, handles low flow discharge	The 3 gates are normally closed, but are opened at least once a year by the owner

VISUAL INSPECTION
 PHASE I
 INSTRUMENTATION

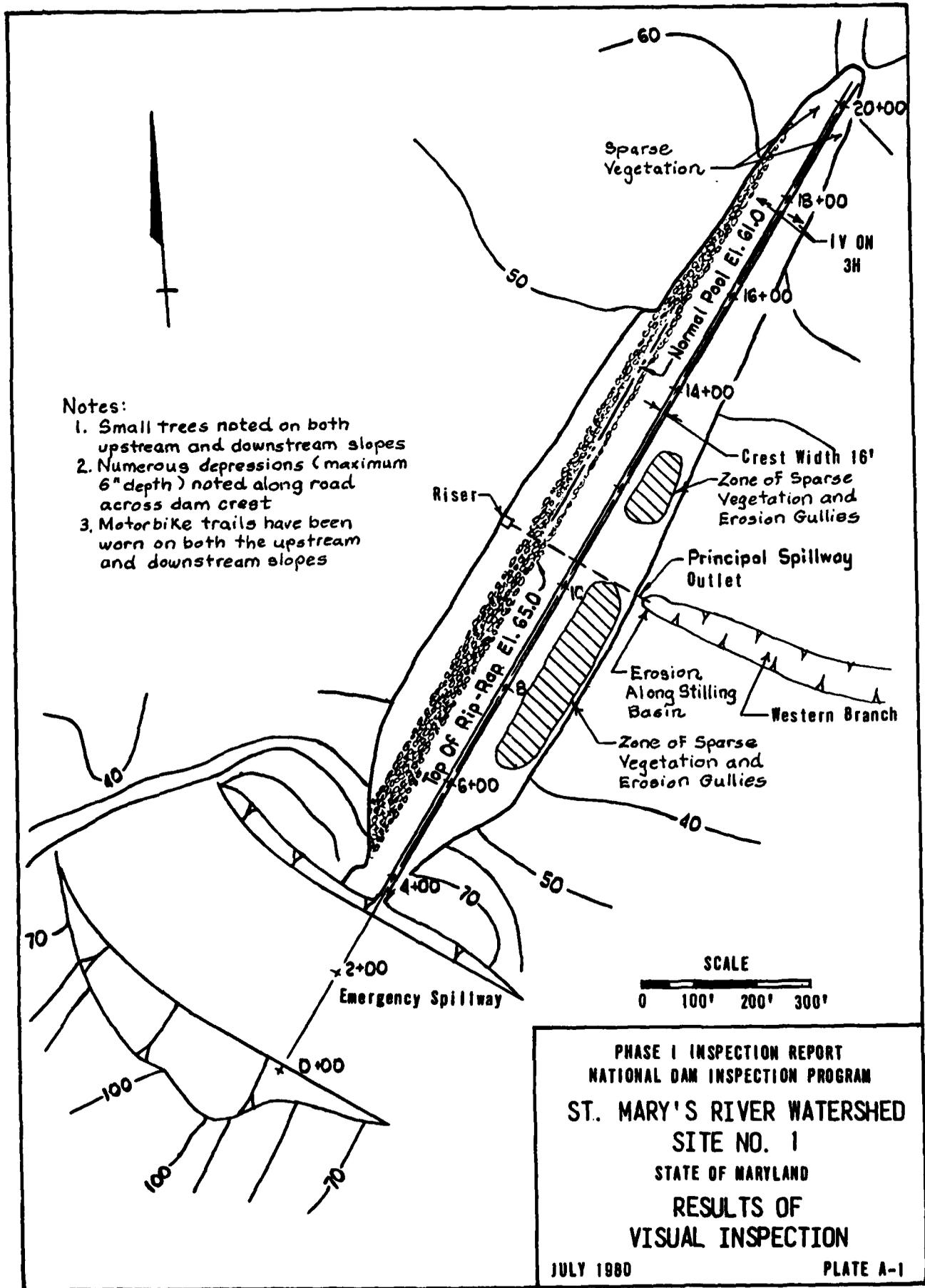
VISUAL EXAMINATION OF MONUMENTATION/SURVEYS	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
OBSERVATION WELLS	Numerous monuments and survey reference points are established on the dam and on fishing peninsulas in lake	Survey reference points on dam were established by Soil Conservation Service
WEIRS	None existing	
PIEZOMETERS	None	
OTHER	None existing	

VISUAL INSPECTION
 PHASE I
 RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Upstream slope of dam protected by riprap; reservoir slopes generally wooded - minor erosion noted	
SEDIMENTATION	Minor amount noted	
UPSTREAM RESERVOIRS	Some farm ponds noted	

VISUAL INSPECTION
 PHASE I
 DOWNSTREAM CHANNEL

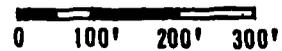
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Erosion noted along right side of stilling basin where riprap protection has been displaced	Repair eroded area and replace riprap on slope
SLOPES	Slopes are nearly vertical; banks of the channel are vegetated.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Only residences noted are downstream of confluence of Western Branch and St. Mary's River	Residence noted on left bank of St. Mary's River at Rte. 471. Motel, residences and small business along floodplain in Great Mills downstream of Rte. 471.



Notes:

1. Small trees noted on both upstream and downstream slopes
2. Numerous depressions (maximum 6" depth) noted along road across dam crest
3. Motorbike trails have been worn on both the upstream and downstream slopes

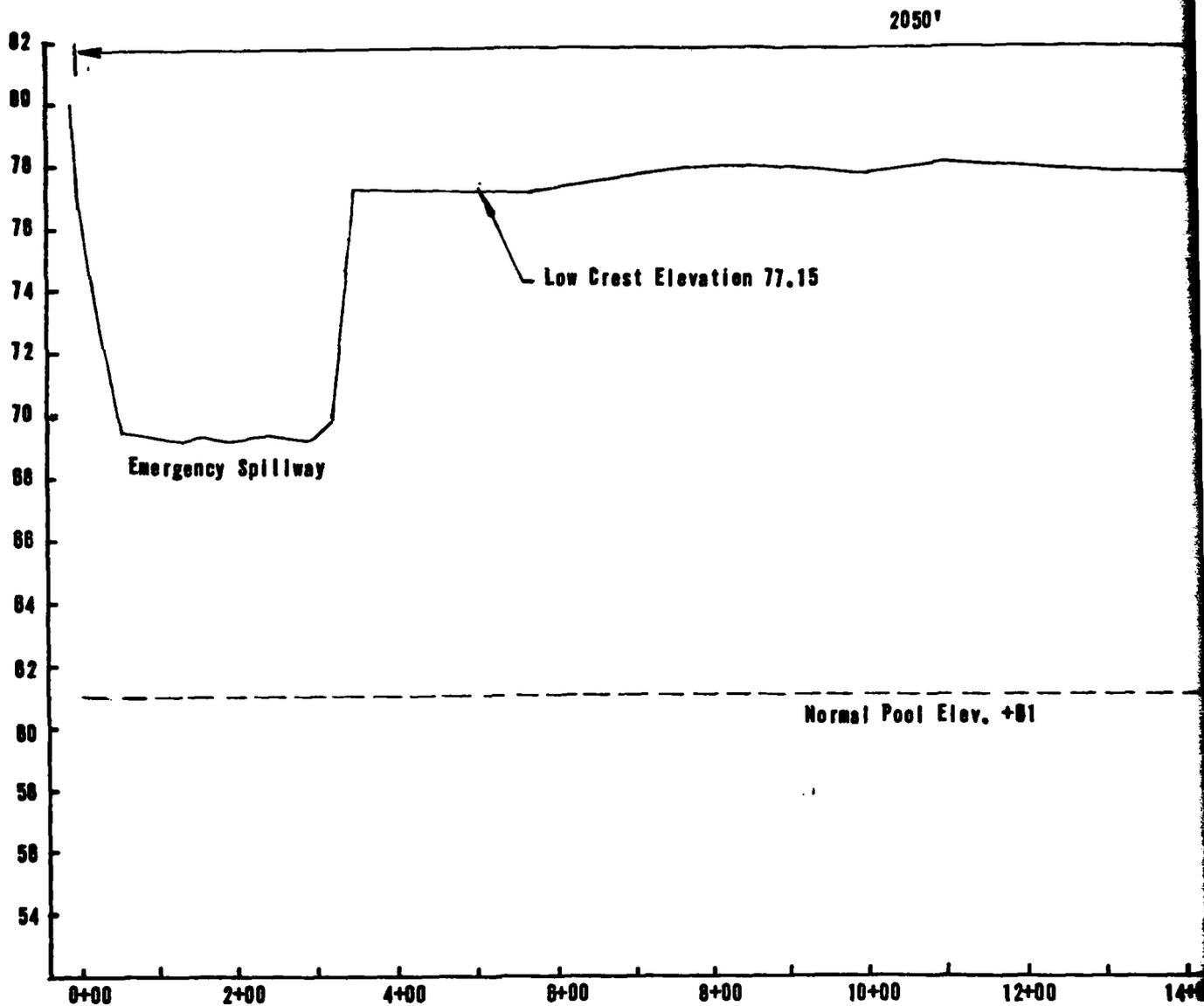
SCALE



PHASE I INSPECTION REPORT
 NATIONAL DAM INSPECTION PROGRAM
 ST. MARY'S RIVER WATERSHED
 SITE NO. 1
 STATE OF MARYLAND
 RESULTS OF
 VISUAL INSPECTION

JULY 1980

PLATE A-1



DAM CREST SURVEY

(LOOKING UPSTREAM)

NOTE:

DAM CREST SURVEY STATIONS
ARE SHOWN ON PLATE A-1

DATUM ELEVATION OBTAINED
FROM PIN SET BY U.S. SOIL
CONSERVATION SERVICE IN
TREE ALONG RIGHT ABUTMENT
OF DAM

2050'

Low Crest Elevation 77.15

Normal Pool Elev. +81

0+00 8+00 10+00 12+00 14+00 16+00 18+00 20+00

DAM CREST SURVEY
(LOOKING UPSTREAM)

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
ST. MARY'S RIVER WATERSHED
SITE NO. 1
STATE OF MARYLAND
DAM CREST SURVEY

JULY 1980

PLATE A-2

APPENDIX B

ENGINEERING DATA CHECKLIST

PHASE I

APPENDIX B

St. Mary's River
 NAME OF DAM Watershed, Site No. 1

CHECKLIST
 ENGINEERING DATA
 DESIGN, CONSTRUCTION, OPERATION
 PHASE I

ID# NDI ID No. MD -

ITEM	REMARKS
AS-BUILT DRAWINGS	As-Built Drawings dated 1976 were provided by the State of Maryland Water Resources Administration
REGIONAL VICINITY MAP	Included on As-Built Drawings
CONSTRUCTION HISTORY	Other than completion date, no construction records available
TYPICAL SECTIONS OF DAM	Included on As-Built Drawings
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	Included on As-Built Drawings or in Design Report dated 1972.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	None at dam site. Stream flow gaging station along St. Mary's River 2.4± miles downstream of dam. Period of record: 1946 to present
DESIGN REPORTS	Design Report entitled, " St. Mary's River Watershed, Site 1," by the U.S. Department of Agriculture, Soil Conservation Service. 1972
GEOLOGY REPORTS	Test boring and test pit locations and logs of each are shown on As-Built Drawings
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Included in Design Report
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Boring records and results of materials investigation are included on As-Built Drawings and in Design Report

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

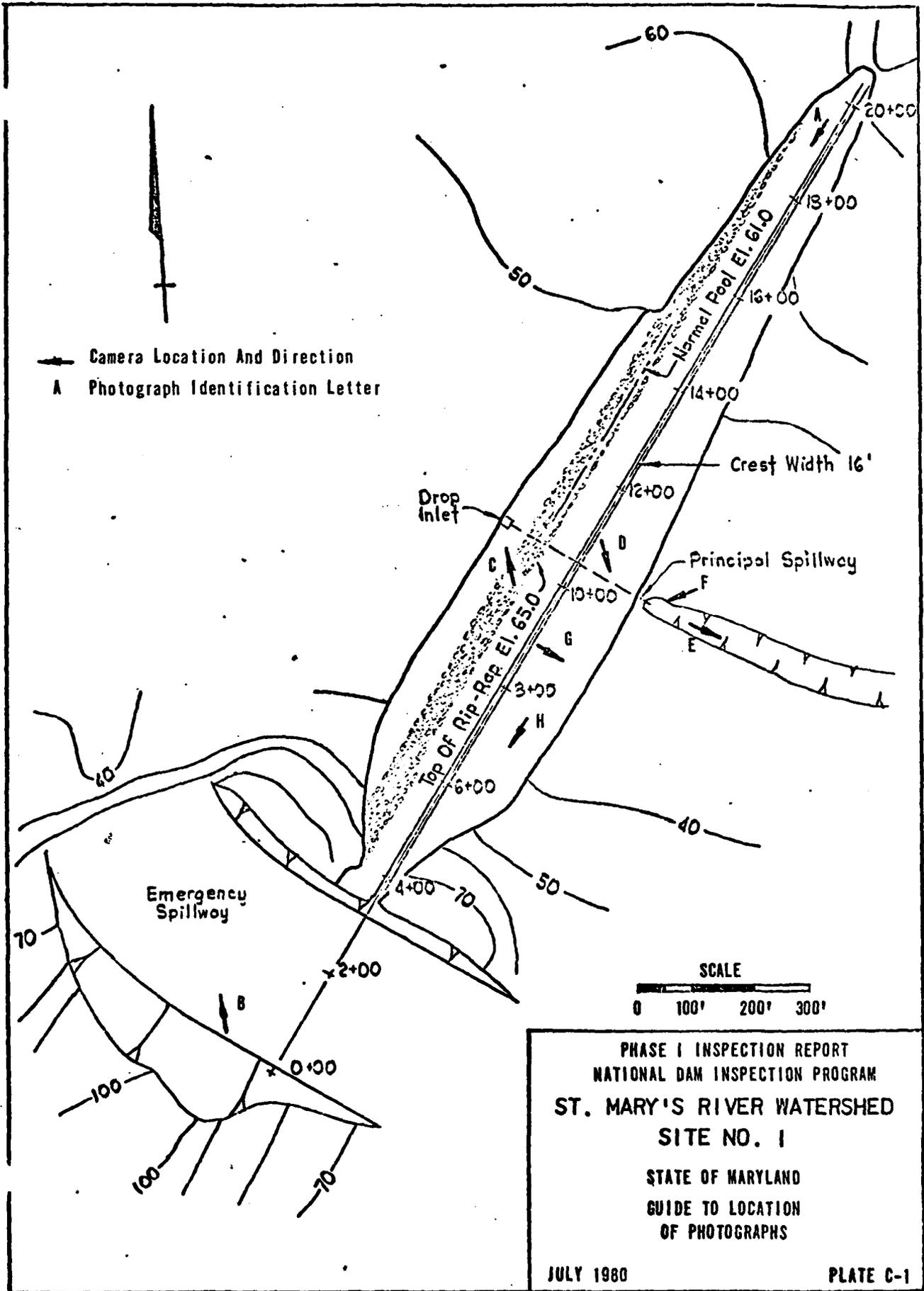
ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	None available.
BORROW SOURCES	Borrow was obtained from excavation of emergency spillway and cutoff trench. Borrow also obtained from area adjacent to left abutment
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	No records available

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	No operation records are maintained. Dam and appurtenant structures are maintained by staff of Point Lookout State Park. Regular inspections are made, and sluice gates opened annually.
SPILLWAY PLAN SECTIONS DETAILS	Included on As-Built Drawings
OPERATING EQUIPMENT PLANS AND DETAILS	Included on As-Built Drawings

APPENDIX C

PHOTOGRAPHS



← Camera Location And Direction
 A Photograph Identification Letter

SCALE
 0 100' 200' 300'

PHASE I INSPECTION REPORT
 NATIONAL DAM INSPECTION PROGRAM
 ST. MARY'S RIVER WATERSHED
 SITE NO. 1
 STATE OF MARYLAND
 GUIDE TO LOCATION
 OF PHOTOGRAPHS

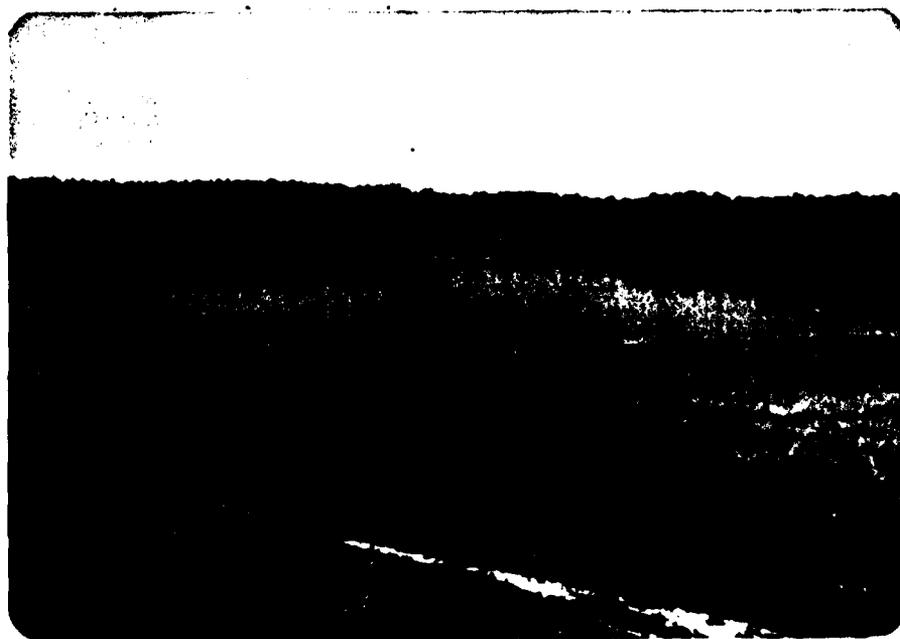
JULY 1980

PLATE C-1

ST. MARY'S RIVER WATERSHED, SITE NO. 1

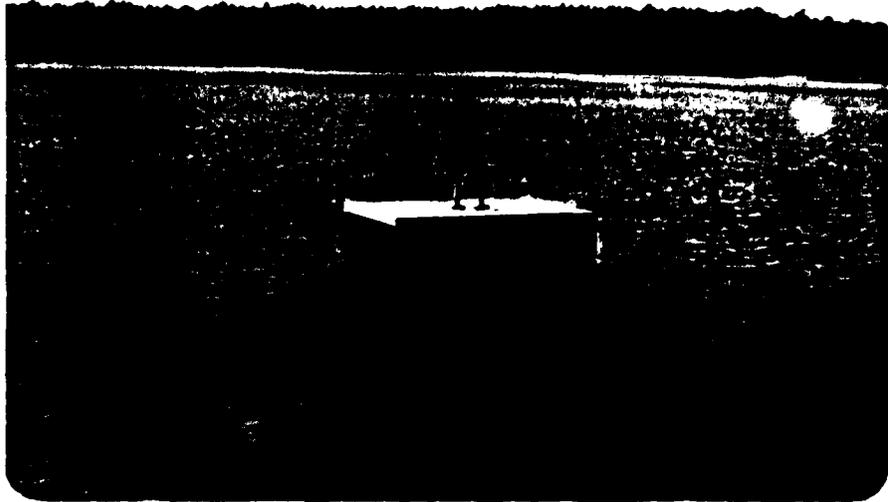


A. Crest of dam



B. Lake and upstream end of emergency spillway

ST. MARY'S RIVER WATERSHED, SITE NO. 1



C. Drop Inlet



D. Outlet conduit and stilling basin

ST. MARY'S RIVER WATERSHED, SITE NO. 1



E. Channel downstream of stilling basin



F. Zone of erosion gullies on downstream slope right of outlet conduit

ST. MARY'S RIVER WATERSHED, SITE NO. 1



G. Erosion gully on downstream slope of dam



H. Downstream slope and right abutment of the dam

APPENDIX D

HYDROLOGY AND HYDRAULICS

BASE DATA FOR DETERMINATION OF PROBABLE
MAXIMUM FLOOD, UNIT HYDROGRAPH AND
INFLOW HYDROGRAPHS

Name of Dam: St. Mary's River Watershed, Site No. 1, NDI-ID-MD-28

Unit Hydrograph Parameters

Watershed Drainage Area	8.76 sq. miles
Main Channel Length, L	5.34 miles
Main Channel to Centroid Length, Lca	2.35 miles
Lag Time $t_p = Ct (L \times Lca)^{0.3}$	1.92 hours
Basin Zone Location from Unit Hydrograph Coefficient Map	34
Basin Coefficients	
C_p^1	0.46
C_t^1	0.90

Inflow Hydrograph Parameters¹

Base Flow at Start of Storm	1.5 c.f.s./sq. mile
Initial Rainfall Loss	1 inch
Uniform Rainfall Loss	0.05 inches/hour
Ratio of Peak Discharge Used to Compute Base Flow which Deviates from Hydrograph Falling Limb	0.05
Ratio of Recession Flow occurring 10 Tabulation Intervals Later	2.0

Rainfall Data²

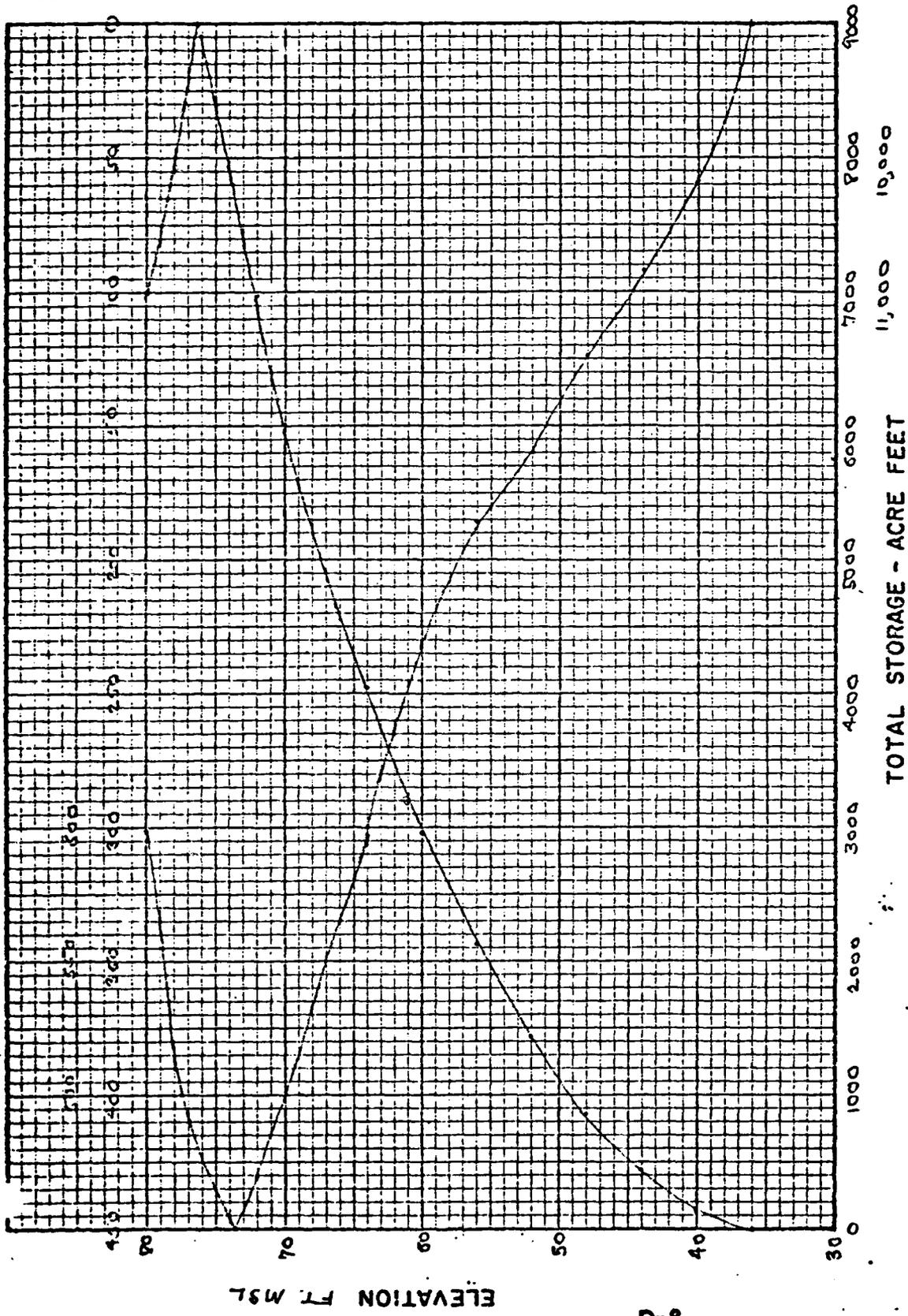
Probable Maximum Precipitation Index for 24 hours and 200 square miles	25.1 inches (Zone 6)
Percentage Adjustments of PMP for Drainage Area	
6 hour storm	112%
12 hour storm	123%
24 hour storm	132%

¹ Basin Coefficients and Hydrograph Data established by Corps of Engineers Baltimore District.

² Hydrometeorological Report 33, Corps of Engineers, 1956

State <u>MARYLAND</u>	Project <u>ST MARY'S SITE #1</u>		
By <u>P.H.S.</u>	Date <u>4/17/72</u>	Checked By <u>RTS</u>	Date <u>6-9-72</u>
Subject <u>AREA CAPACITY CURVES</u>			Job No. <u>MD-184</u>
			Sheet <u>3</u> of <u>15</u>

AREA - ACRES



6-D

SPILLWAY/OUTLET RATING CURVES

Name of Dam: St. Mary's River Watershed, Site No. 1, NDI-ID-MD-28

<u>Pool Elevation</u> feet above m.s.l.	<u>Principal Spillway Capacity</u> c.f.s.	<u>Emergency Spillway¹ Capacity</u> c.f.s.	<u>Total Flow</u> c.f.s.
61	0		0
63	140		140
65	146		146
67	152		152
69	157		157
69.5	160	0	160
71	163	1500	1663
73	168	5200	5368
75	173	11800	11973
77	178	19700	19878
79	183	29000	29183

Principal Spillway Calculations

Weir Control (Elevation 61 to 63)

$$Q = CLH^{1.5}$$

$$= 3.1 \times 18 \text{ ft.} \times H^{1.5}$$

$$= 55.8 H^{1.5}$$

Where H = Pool Elevation
minus 61

Conduit Control (Elevation 63 to 79)

$$Q = C_p H^{1/2}$$

where $C_p = A_p \sqrt{\frac{2g}{1 + K_e + \frac{29.1(n)^2 L}{r^{4/3}}}}$

$$C_p = 29.5$$

$$Q = 29.5 H^{1/2}$$

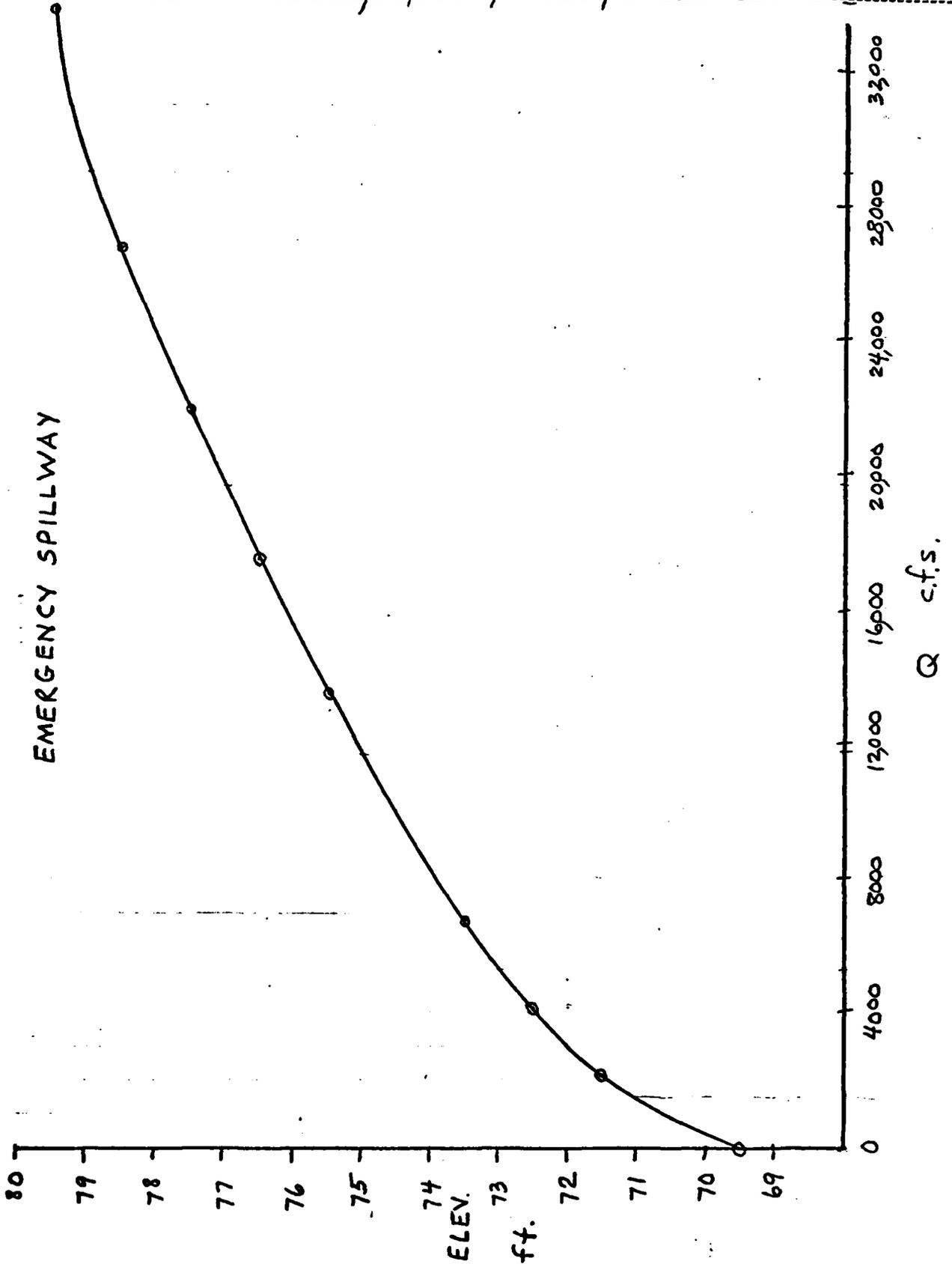
Where H = Pool Elevation
minus 40.5

¹ Based on Design Report, St. Mary's River Watershed Site 1,
Soil Conservation Service, 1972.

BY G.E.S. DATE 7/23/30
CHKD. BY J.D. DATE 8/7/30

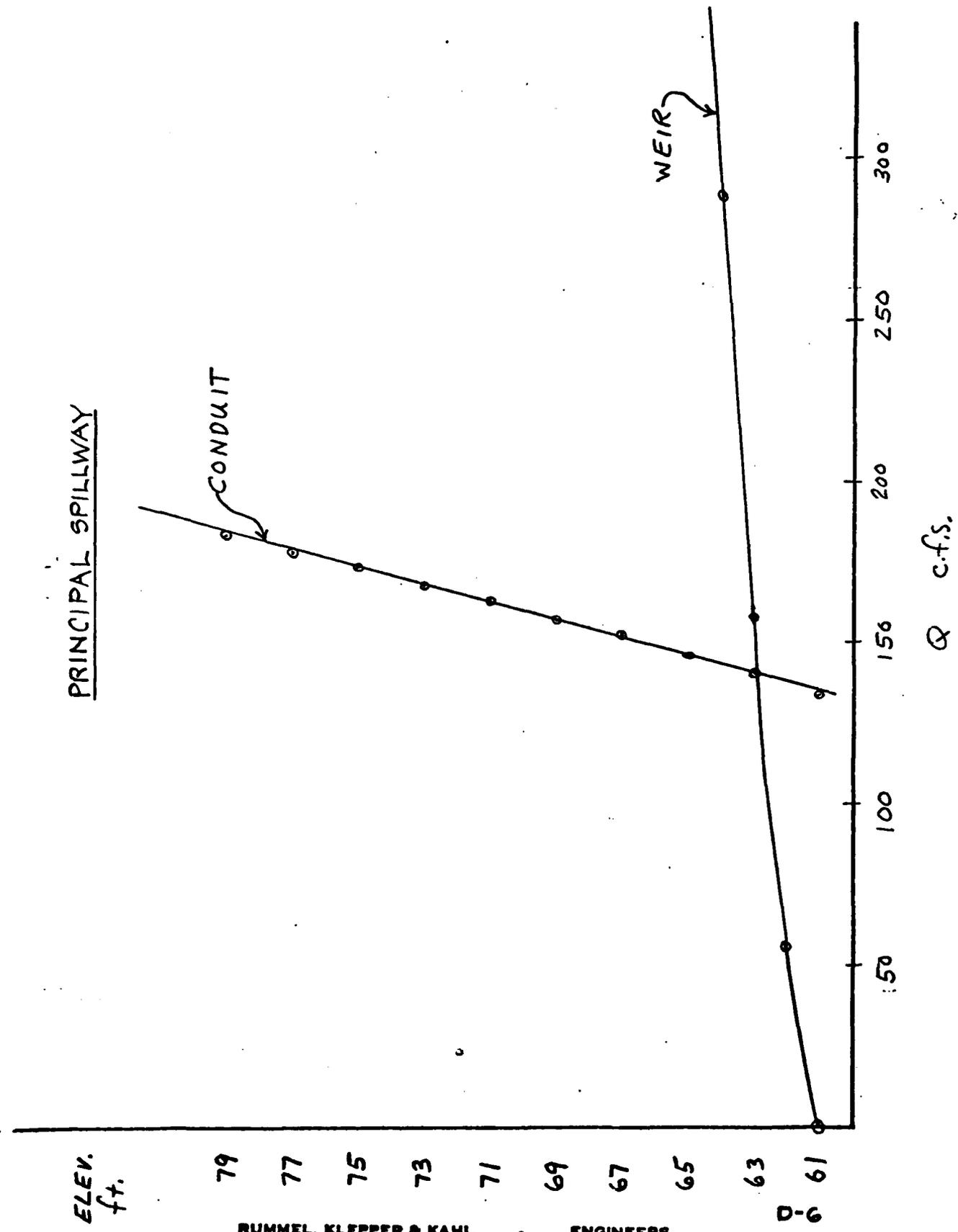
SUBJECT St. Mary's River
Emerg. Spillway Rating Curve

SHEET NO. 9 OF
JOB NO. 580-21-4D



BY GES DATE 8/4/80 SUBJECT St. Mary's River Watershed SHEET NO. 10 OF
 CHKD. BY JD DATE 8/7/80 Principal Spillway JOB NO. 580-21-40
Weir and Outlet Structure Rating Curve

PRINCIPAL SPILLWAY



 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 06 FEB 80

SNYDER UNIT HYDROGRAPH, FLOOD ROUTING AND DAM OVERTOPPING ANALYSES FOR
 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% AND 100% PMF AT ST. MARY'S RIVER DAM
 SITE 1. NDI-I.D. -HD28 COMM. NO. 580-21-4D

JOB SPECIFICATION															
NG	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN						
150	0	15	0	0	0	0	0	-4	0						
JOPER				NWT				LROPT				TRACE			
S				0				0				0			

MULTI-PLAN ANALYSES TO BE PERFORMED

RTIOS= 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00
 NPLAN= 1 NRTIO= 9 LRTIO= 1

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF SNYDER UNIT HYDROGRAPH TO ST. MARY'S RIVER DAM
 ISTAT ICOMP IECON ITAPE JPLT JPRT INAME ISTAT IAUTO

HYDROGRAPH DATA											
IHYDQ	IUHQ	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNDW	ISAME	LOCAL		
1	1	8.76	0.00	8.76	0.00	0.000	0	0	0		

TRSPC COMPUTED BY THE PROGRAM IS 0.800

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	25.10	112.00	123.00	132.00	0.00	0.00	0.00

LOSS DATA											
LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSNX	RTIMP	
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.05	0.00	0.00	

UNIT HYDROGRAPH DATA
 TP= 1.92 CP=0.46 NTA= 0

RECESSION DATA
 STATG= -1.30 GRCSN= -0.05 RTIOR= 2.00

UNIT HYDROGRAPH 68 END-OF-PERIOD ORDINATES, LAG= 1.94 HOURS, CP= 0.46 VOL= 1.00											
56.	208.	425.	678.	938.	1155.	1302.	1366.	1321.	1217.		
1119.	1029.	947.	871.	801.	736.	677.	623.	573.	527.		
485.	446.	410.	377.	347.	319.	293.	270.	248.	228.		
210.	193.	177.	163.	150.	138.	127.	117.	107.	99.		
91.	84.	77.	71.	65.	60.	55.	51.	47.	43.		
39.	36.	33.	31.	28.	26.	24.	22.	20.	19.		
17.	16.	14.	13.	12.	11.	10.	9.	8.	7.		

MO. DA HR. MN PERIOD RAIN EXCS LOSS COMP G MO. DA HR. MN PERIOD RAIN EXCS LOSS CO G

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS								
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
HYDROGRAPH AT	1	8.76	1	4119.	6178.	8237.	10297.	12356.	14415.	16475.	18534.	20593.
	(	22.69)	(	116.63)	(174.94)	(233.26)	(291.57)	(349.89)	(408.20)	(466.51)	(524.83)	(583.14)
ROUTED TO	2	8.76	1	153	661.	2194	4181.	6664.	9238.	11665.	14145.	16462
	(	22.69)	(	4.33)	(18.71)	(62.13)	(118.39)	(188.71)	(261.60)	(330.30)	(400.56)	(466.15)

SUMMARY OF DAM SAFETY ANALYSIS

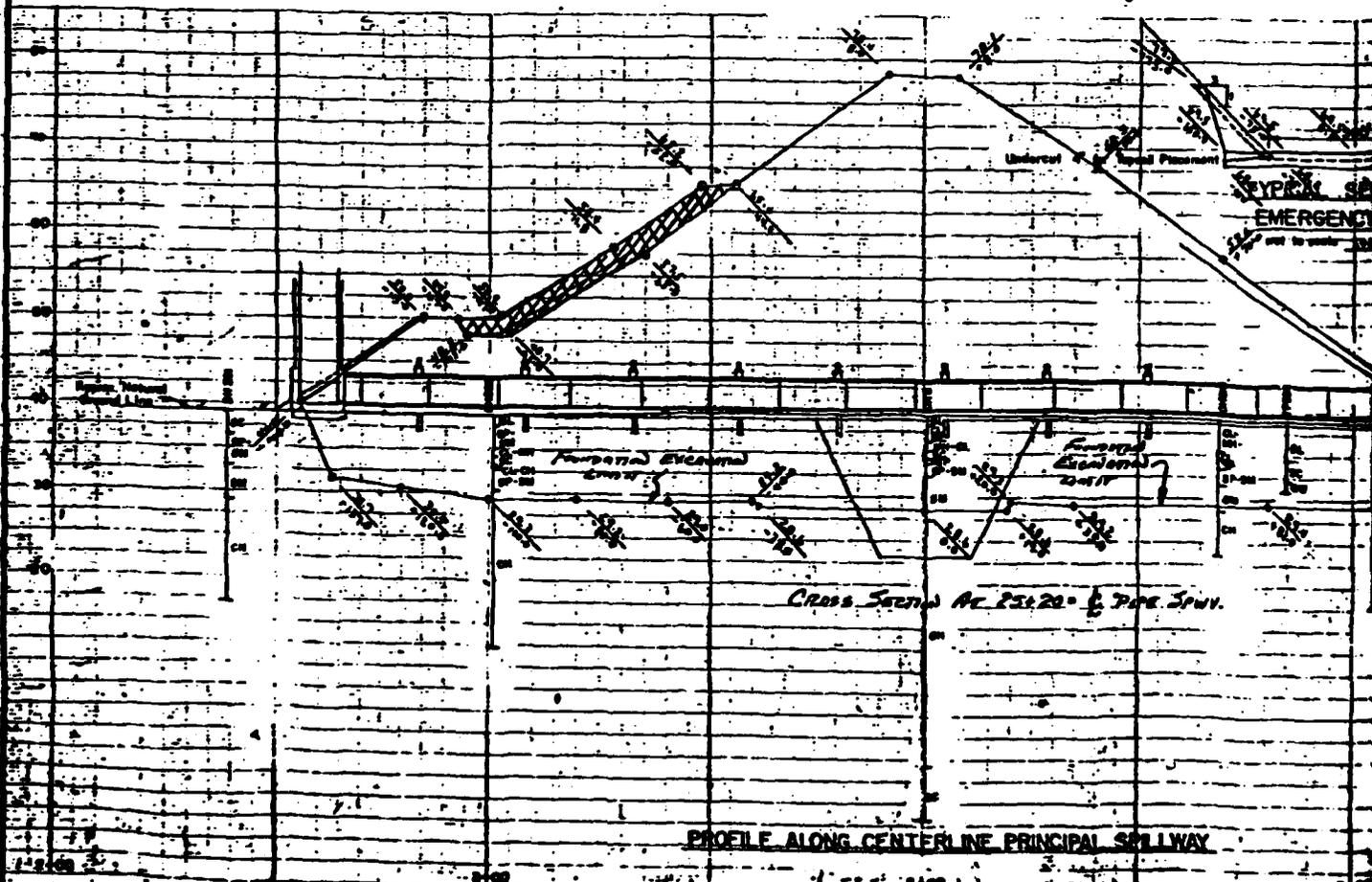
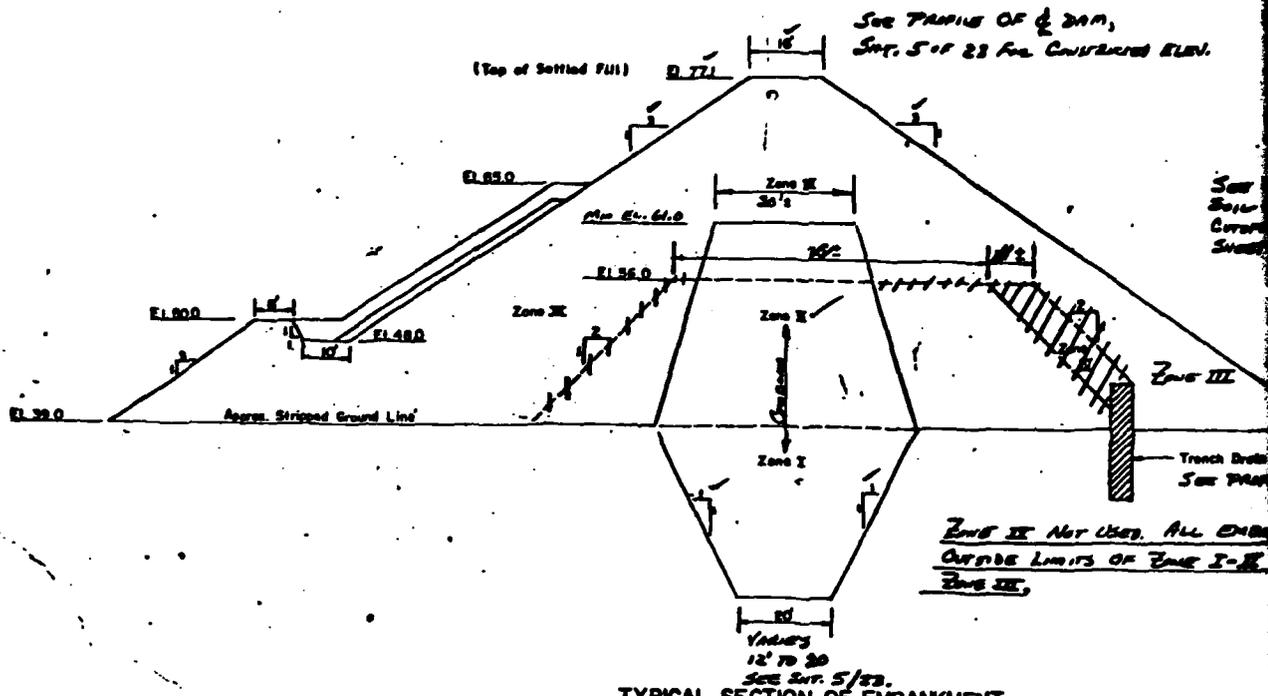
PLAN 1	ELEVATION STORAGE OUTFLOW	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM	TIME OF FAILURE HOURS
		60.91	69.50	77.15	0.00
		3200.	6055.	8400.	0.00
		0.	160.	20576.	0.00

RATIO OF PMF	MAXIMUM RESERVOIR W. S. ELEV	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.20	67.42	5289.	153.	0.00	29.50	0.00
0.30	70.00	6239.	661.	0.00	26.00	0.00
0.40	71.29	6713.	2194.	0.00	23.00	0.00
0.50	72.36	7074.	4181.	0.00	21.50	0.00
0.60	73.39	7360.	6664.	0.00	20.75	0.00
0.70	74.17	7576.	9238.	0.00	20.00	0.00
0.80	74.91	7779.	11665.	0.00	19.75	0.00
0.90	75.55	7957.	14145.	0.00	19.50	0.00
1.00	76.14	8119.	16462.	0.00	19.25	0.00

11

APPENDIX E

PLATES

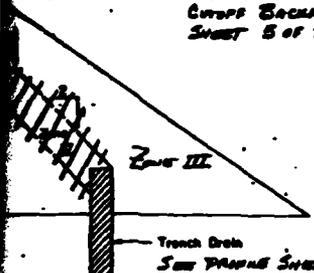


Zone II Material From Cutoff Trenches
 Washed In Permanent Pool Area.

200,
 Contained Elev.

SEE NOTE FOR
 SOIL USED IN
 CUTOFF BACKFILL,
 SHEET 5 OF 23.

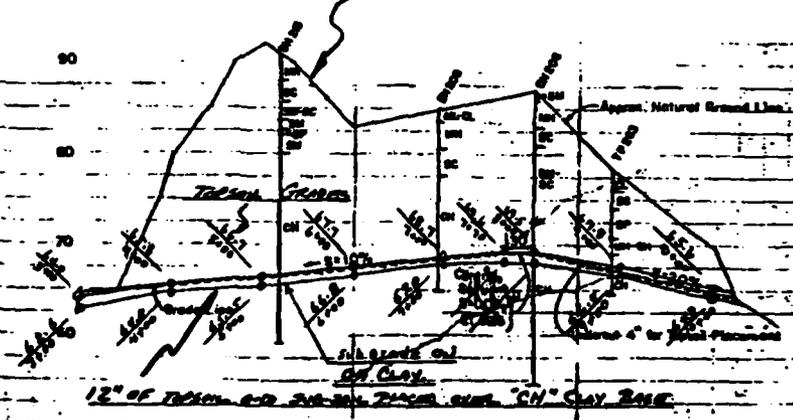
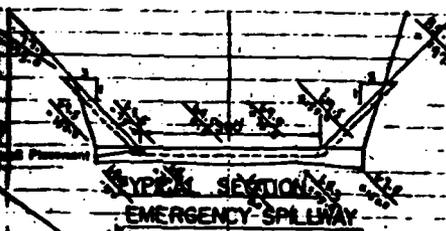
Zone No.	Type USCS	Source Location	Represented by Material In	Compaction Requirements	Moisture Limits % ± Optimum	Max. Patch Size	Maximum Lift Prior To Compaction
I	SP GC GC	Emerg. Spwy.	DH21, DH206 (From 4.0' To 7.0') DH207 (From 2.0' To 3.0') DH204 (From 4.0' To 8.0')	Class A, 99% Min Density, ASTM D-698 MTD A	-1 To +2	6'	6'
II	CH CH CH	Emerg. Spwy.	DH213 (From 1.0' To Bot. E. Spwy.) DH208 (From 7.0' To Bot. E. Spwy.) DH253 (From 9.5' To Bot. E. Spwy.)	Same As Above	-2 To +5	5'	6'
III	CL SC SM SM SM	Borrow Area	TP65 (From 0.5' To 7.5') TP68 (From 7.0' To 10.0') TP69 (From 2.0' To 4.0') TP120 (From 8.0' To 12.0')	Same As Above	-1 To +2	6'	6'
III	SP-SM GW SP-SM	Cutoff Trench Washed	TP61 (From 7.0' To 12.0') TP76 (From 3.0' To 9.5') DH2 (From 4.0' To 10.0')	N/A Same As Above	N/A -1 To +2	N/A 6'	N/A 6'



NOT USED. ALL EMBANKMENT
 LIMITS OF ZONE I-III IS

- Zone I Material May Require Scarifying For Drying Or Water Added To Meet The Required Moisture Limits.
- Zone I Material Shall Not Be Placed Next To The Principal Spillway Pipe. Zone I Or II Material Shall Be Used As Directed By The Engineer.
- Zone II Material Shall Be Selectively Placed As Directed By The Engineer.

NOTE: ORIGINAL GROUND LINE DRAINAGE DRAIN
 NOT MATCH ACTUAL FIELD GROUND LINE.



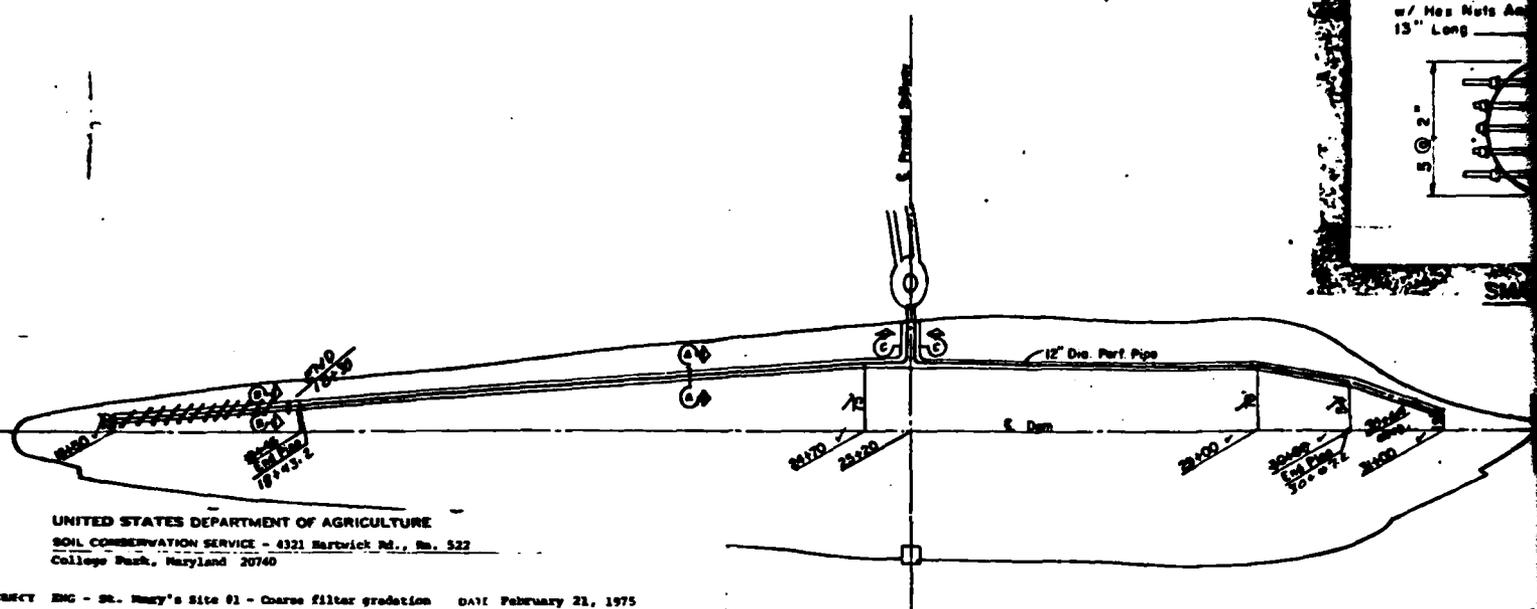
AS BUILT

ST. MARYS RIVER WATERSHED
 ST. MARYS CO., MARYLAND
 SITE I
 SPILLWAY EXCAVATION AND FILL PLACEMENT
 U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

Designed by	Date	Approved by
A. H. BOW	2-72	
A. H. BOW	2-72	
J. R. BOW	2-72	
J. R. BOW	2-72	

MD-401-P

3/8" Dia Bolts
w/ Hex Nuts And
13" Long



UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE - 4321 Hartwick Rd., Rm. 522
College Park, Maryland 20740

SUBJECT: ENG - Mr. Wray's Site #1 - Coarse filter gradation DATE: February 22, 1975

TO: Richard J. Barabak, Government Representative
SCS, Hagerstown, Maryland

I have checked the permeability of the four samples of coarse filter material (Nos. 602, 603, 612, and 624) submitted by the contractor. The permeability of these samples is approximately 2500 Spd, the value used in the design of the coarse section of the filter trench. Therefore, material represented by the samples submitted would be acceptable.

I have also recomputed the coarse filter limits; they are as follows:

Sieve No.	Percent Passing
3/4"	100
1/2"	90-100
3/8"	60-85
4	20-45
8	0-20
16	0-8
30	0-5
200	less than 2

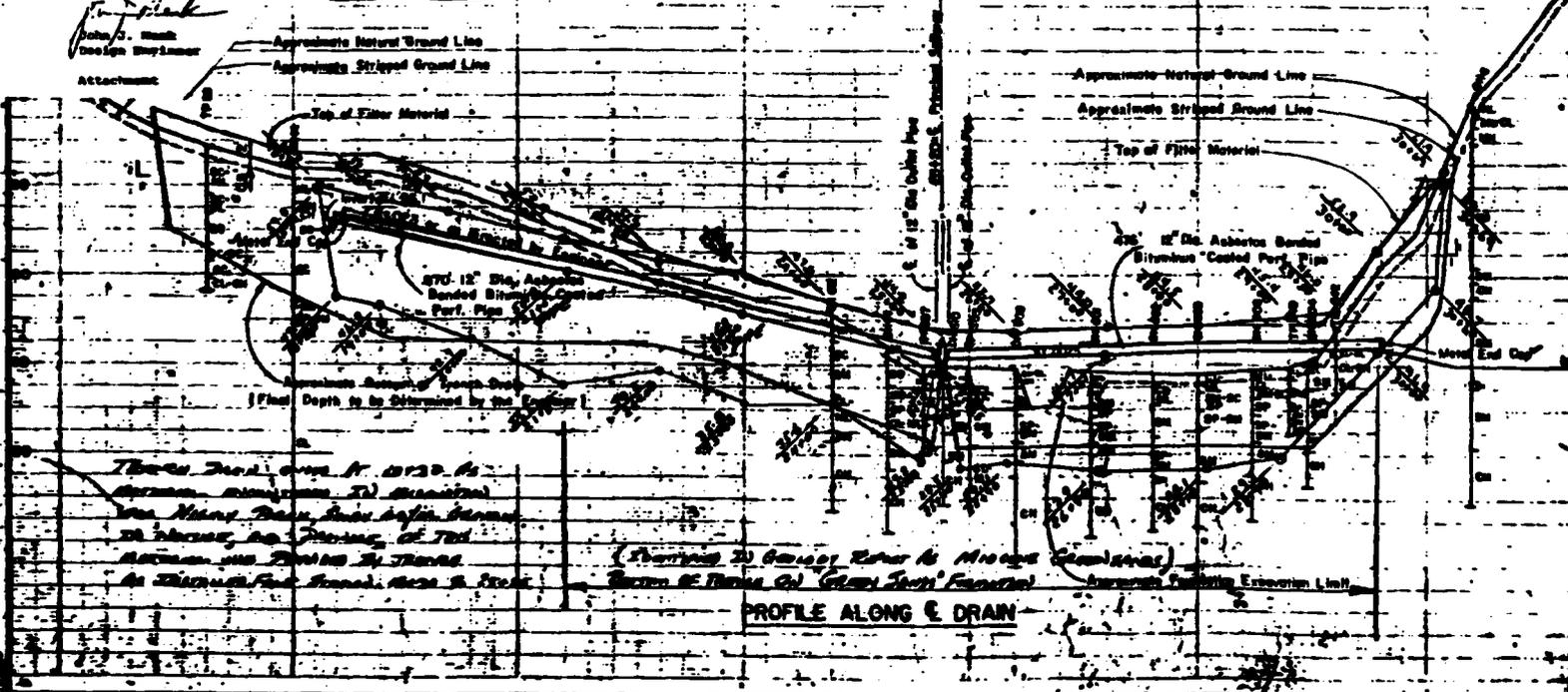
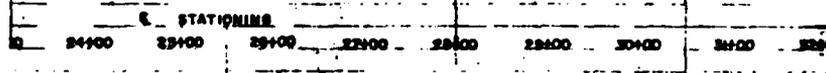
I don't believe it is necessary to modify the contract for this change, but the revised limits should be shown as a red line change on the AS-BUILD plans.

I'm attaching the data on the four samples that you left with me yesterday. If you have any questions, give me a call.

John J. Shank
John J. Shank
Design Engineer

PLAN OF DRAINAGE SYSTEM

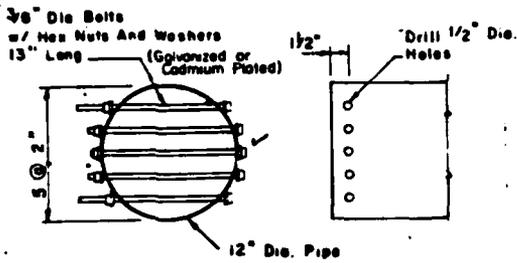
Scale: 1" = 100'



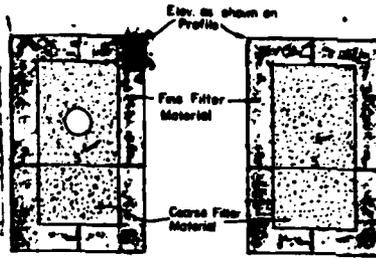
PROFILE ALONG E DRAIN

These notes are to be used as a guide only. The contractor is to determine the exact depth to be determined by the Engineer.

*(Continued to General Notes to Mission Stationing)
Section of the Drain to be 12" Dia. Asbestos Bonded Bituminous Coated Perforated Pipe*

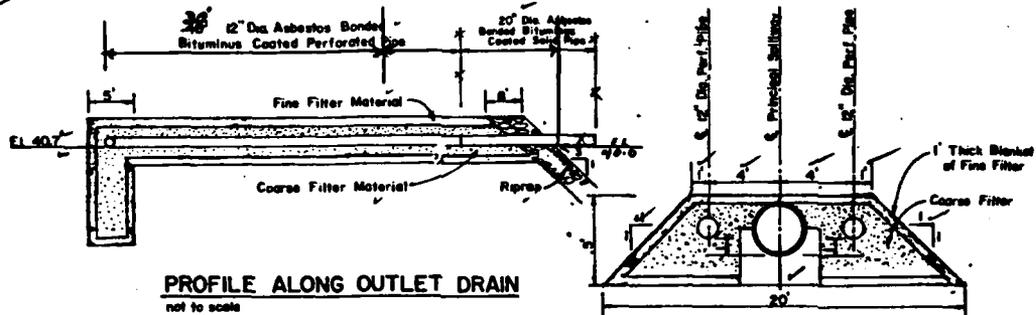


SMALL ANIMAL GUARD DETAILS

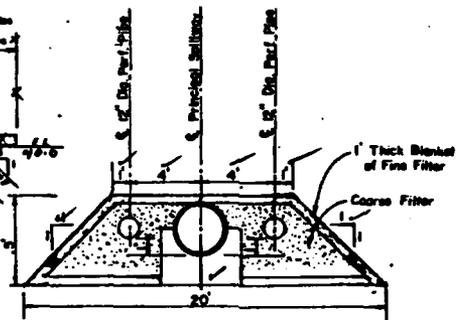


SECTION A-A
not to scale

SECTION B-B
not to scale



PROFILE ALONG OUTLET DRAIN
not to scale



SECTION C-C
not to scale

28400 28400 30400 30400 32400

ACTUAL QUANTITY	FINE FILTER		COARSE FILTER		ACTUAL QUANTITY
	Sieve No.	% Passing	Sieve No.	% Passing	
100	3/8 inch	100			100
97	4	95-100	3/4 inch	100	100
82	8	60-100	1/2	90-100	90
66	16	50-85	3/8	80-90	74
50	30	25-60	4	70-80	85
21	90	10-30	8	60-70	6
14	100	2-10	16	50-60	4
0.8	200	< 3%	30	4-5	3
			60	< 3	0.8

NOTE:
Grading of aggregates shall conform to ASTM Spec. C33-67.
Coarse aggregates shall be clean.
See Recommendation on 2/21/55
LETTER FOR GRADING.

CONSTRUCTION DETAILS

- The profiles of the bottom of all excavations as shown are approximate. The required final grades will be established by the Engineer.
- Quality of drain fill material shall be in accordance with Specification 501.
- All drain pipes shall conform to the provisions of Specification 501 and shall be 16 gauge, Class 1, 20M.S.I., Type B.
- All perforated drain pipes shall have hole diameter of 3/8 inch.
- For description of type of mesh holes and their size, see Sheets 17, 18, 23.

ACTUAL QUANTITY SUMMARY

- 326.6 } 1940 Cu. Yds. Coarse Filter
- 1830 Cu. Yds. Fine Filter
- 4222.5 1000' of 12" Dia. Perf. A.B.B.C.C.M.P.
- 140' of 6" Dia. Non-Perf. A.B.B.C.C.M.P.
- 1 - 8 Piece 20" 20M.S.I. 16-Gauge, Class 1
- 2 - Metal End Caps

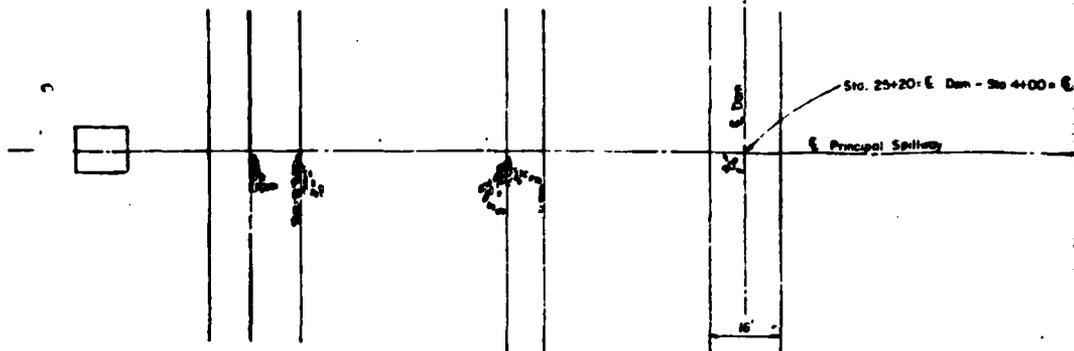
AS BUILT

**ST. MARYS RIVER WATERSHED
ST. MARYS CO., MARYLAND
SITE I
TRENCH DRAIN DETAILS**

**U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE**

Designed	Date	Approved by
A. H. RYAN	9-22-54	
Drawn	Date	Checked
A. H. RYAN	9-22-54	
Checked	Date	Permitted
J. J. RYAN	9-22-54	
Approved	Date	Project No.
B. C. RYAN	10-22-54	MD-484-P

PLAT

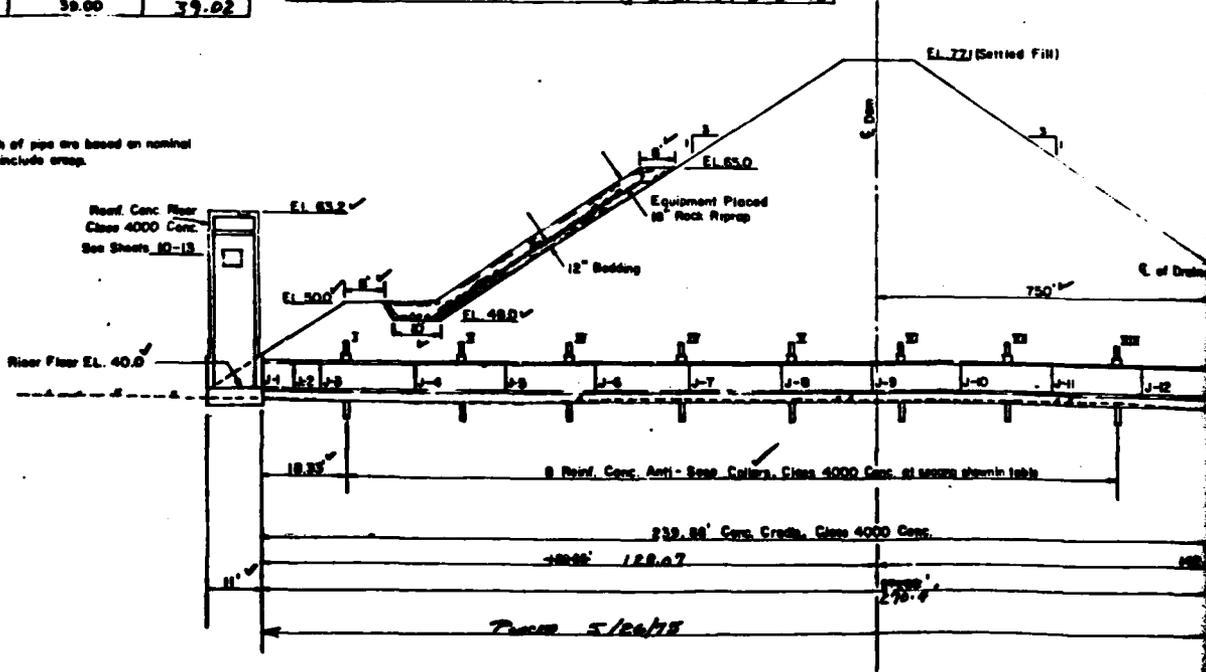


PLAN VIEW
SCALE: 1" = 20'

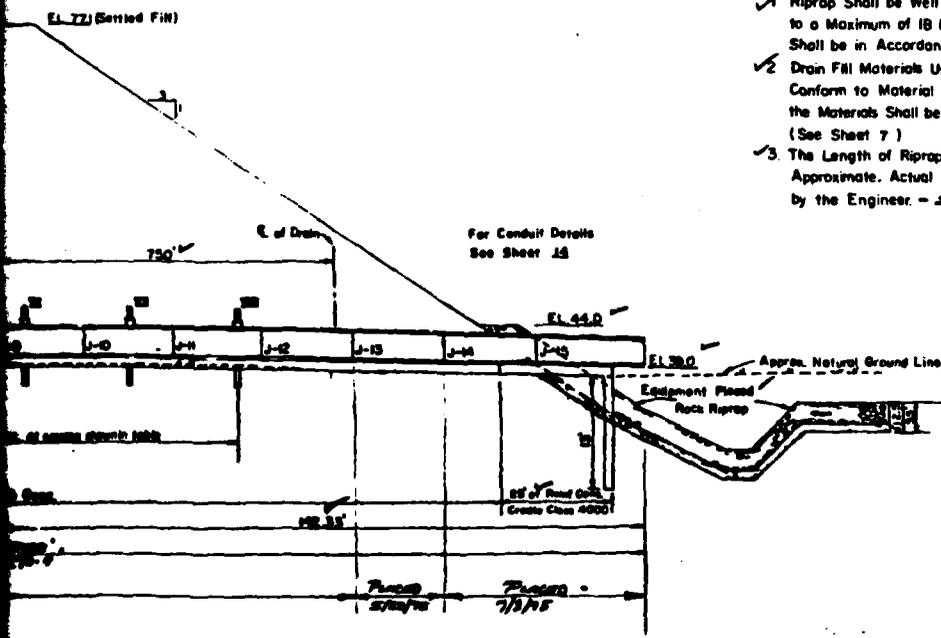
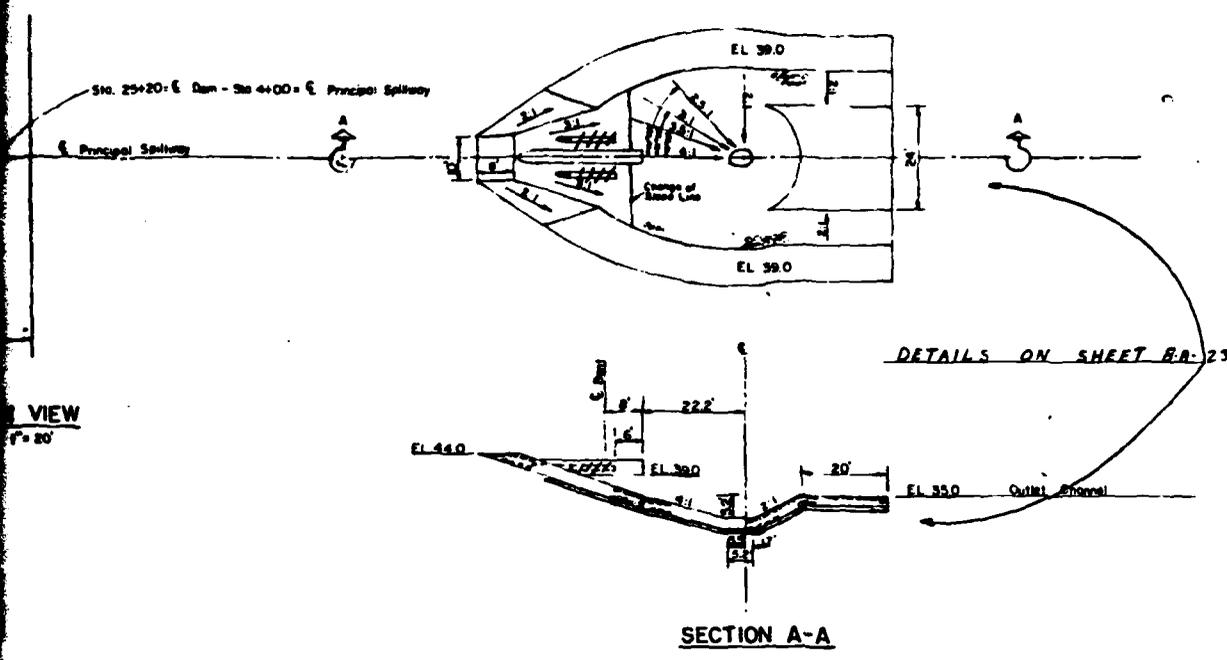
JOINT	DISTANCE FROM RISER WALL	INVERT ELEV. OF 36" DIA. PIPE	HYDRAULIC ELEV. @ 100 CFS
J-1	0.33	40.00	79.98
J-2	7.30	40.00	40.00
J-3	12.99	40.00	40.00
J-4	32.93	39.99	79.99
J-5	52.87	39.99	79.99
J-6	72.81	39.99	79.97
J-7	92.75	39.97	79.97
J-8	112.69	39.96	79.95
J-9	132.63	39.95	79.94
J-10	152.57	39.95	79.97
J-11	172.51	39.87	79.85
J-12	192.45	39.78	79.75
J-13	212.39	39.63	79.63
J-14	232.33	39.48	79.50
J-15	252.27	39.29	79.30
Outlet	272.21	39.00	79.02

COLLAR	DISTANCE FROM RISER WALL	INVERT ELEV. OF 36" DIA. PIPE	DATE CONCRETE POURED	BASE TO P
I	18.33 ✓	40.00 ✓	5-21-75	7-3-75
II	42.33 ✓	39.99 ✓	5-21-75	6-19-75
III	66.33 ✓	39.98 ✓	5-21-75	6-19-75
IV	90.33 ✓	39.97 ✓	5-21-75	6-17-75
V	114.33 ✓	39.96 ✓	5-21-75	6-17-75
VI	138.33 ✓	39.95 ✓	5-21-75	6-11-75
VII	162.33 ✓	39.91 ✓	5-21-75	6-10-75
VIII	186.33 ✓	39.80 ✓	5-21-75	6-5-75

NOTE:
Dimensions for length of pipe are based on nominal lengths and do not include creep.



PROFILE ALONG CENTERLINE OF PRINCIPAL SPILL
NOT TO SCALE



CONSTRUCTION DETAILS

- ✓ Riprap Shall be Well Graded from a Minimum of 6 Inches to a Maximum of 18 Inches in its Longest Dimensions and Shall be in Accordance with Material Specification 523.
- ✓ Drain Fill Materials Used in Bedding Layers for Riprap Shall Conform to Material Specification 521. The Gradation of the Materials Shall be the Same as Coarse Filter Material (See Sheet 7)
- ✓ The Length of Riprap Required in the Exit Channel is Approximate. Actual Length will be Determined in the Field by the Engineer. - See R-50 SHEET RA of 23

ROCK FROM
BOCAVILLE, MD.
QUARRY.

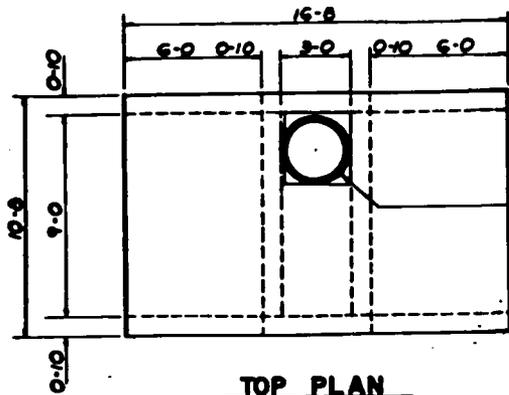
Bottom of Outlet Channel
Bottom Width - 24'
Side Slope - 2:1
See Detail Sheet 5

A S BUILT
PIPE JOINT LENGTHS REVISED 4/75

ST. MARYS RIVER WATERSHED ST. MARYS CO., MARYLAND SITE 1 PLAN - PROFILE OF PRINCIPAL SPILLWAY U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designer: A. H. SMITH Date: 8-72	Checked: A. H. SMITH Date: 8-72	Approved: _____ Date: _____	Project No.: MD-494-2
Drawn: J. L. RYAN Date: 8-72	Checked: E. S. GORMAN Date: 2-73	Approved: _____ Date: _____	Project No.: MD-494-2

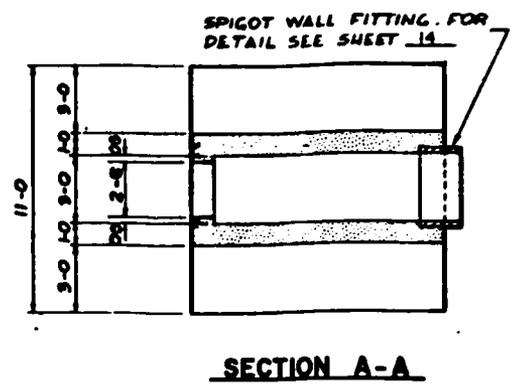
CENTERLINE OF PRINCIPAL SPILLWAY
TO SCALE

PLAN

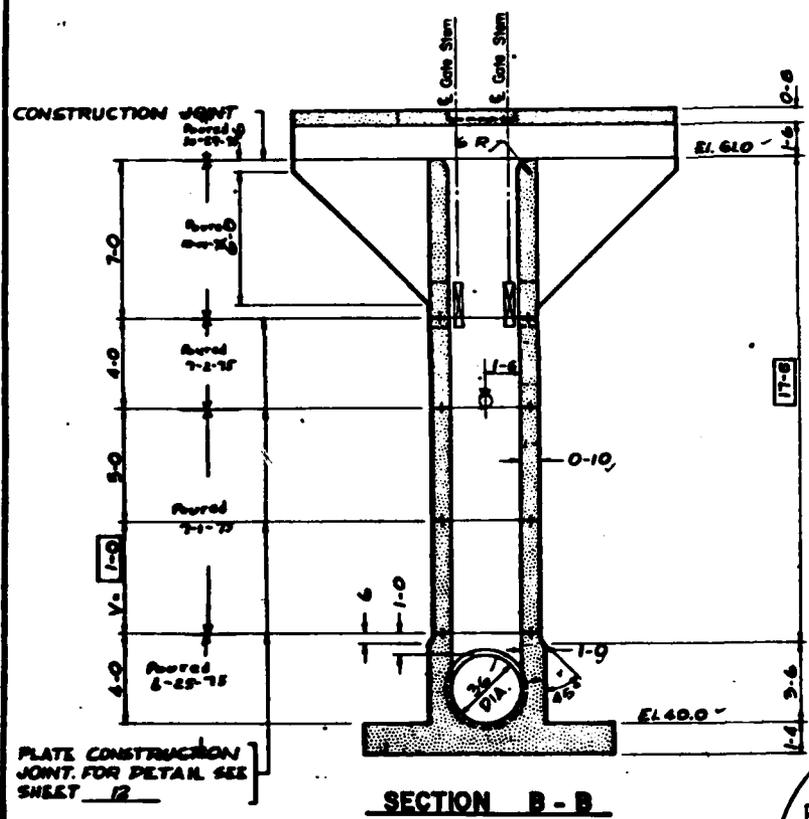


REVISED SEE SHEET 16A of 23
ALUMINUM MATCH - 36" x 36"

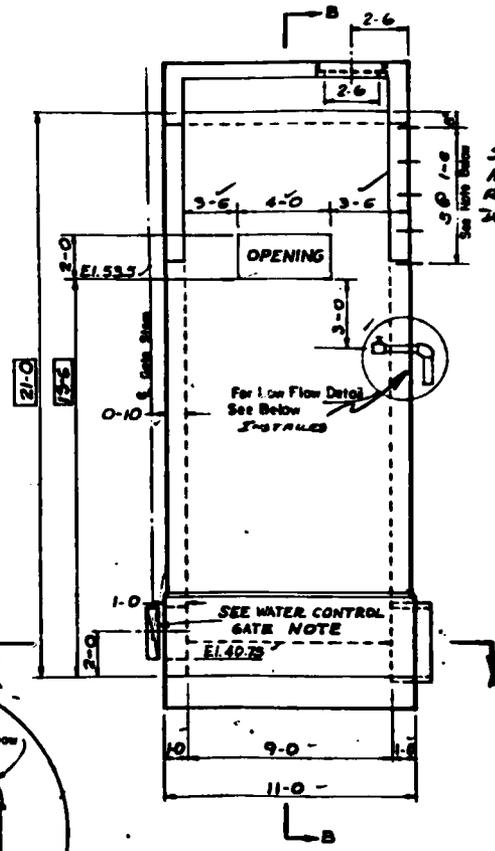
FOR DETAIL OF TRASH-RACK ANGLES AND GRATING SEE SHEET 16



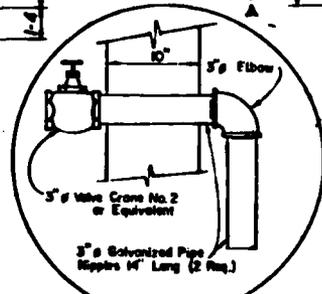
SECTION A-A



SECTION B-B



SIDEWALL ELEVATION



LOW FLOW DETAIL

0 1 2 3 4 5 6 7 8 9
SCALE IN FEET

STANDARD COVERED RISER	
DESIGN CONSTANTS	$f'_c = 4000$ psi $f'_t = 1600$ psi $n = 8$ $f'_s = 20,000$ psi
STANDARD Dwg. No.	ES-3036-2505 R
DATE 3-65	SHEET 1 OF 4

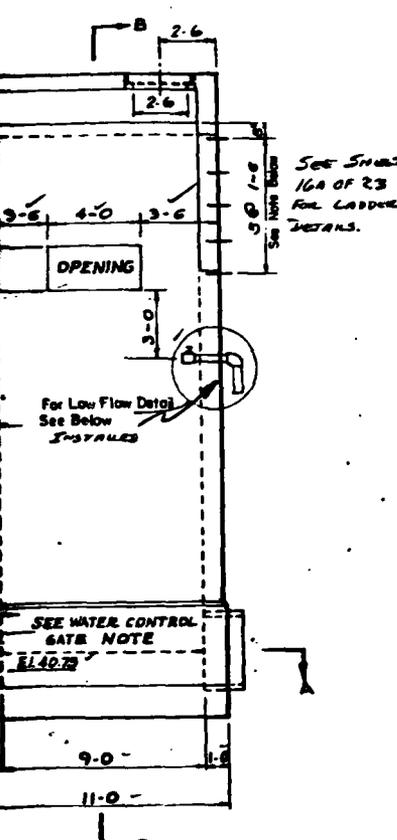
LOEWER SARGENT & ASSOC.
ARCHITECTS & ENGINEERS
3720 FARRAGUT AVE., KENNINGTON, MD.

NOTE:
Steps to be located in center of riser
See Section A-1001 - Equat.
Detailed - See Sht. 16A of 23

- CONSTRUCTION DETAILS FOR ALL CONCRETE**
- ✓ All Concrete Shall be Class 4000.
 - ✓ Portland Cement Type I A or Type I with Air-Entraining Admixture Shall be Used.
 - ✓ All Reinforcing Steel Placed in Concrete Placed Against the Ground Shall Have a Minimum of 3" Clear Cover. Where Forms are Used Bars Shall Have a Minimum of 2" Clear Cover.
 - ✓ All Exposed Edges of Concrete to Have a 3/4" Chamfer Unless Otherwise Specified.
 - ✓ Coarse Aggregate Shall be Size 57, Spec. 322

NOT WALL FITTING FOR
FAIL SEE SHEET 14

SECTION A-A



WALL ELEVATION

CONSTRUCTION DETAILS FOR ALL CONCRETE
 All Concrete Shall be Class 4000.
 Portland Cement Type I A or Type I with
 Air-Entraining Admixture Shall be Used.
 All Reinforcing Steel Placed in Concrete Poured
 Against the Ground Shall Have a Minimum of 3"
 Clear Cover. Where Forms are Used Bars Shall
 Have a Minimum of 2" Clear Cover.
 All Exposed Edges of Concrete to Have a 3/4"
 Chamfer Unless Otherwise Specified.
 Surface Approval Shall be Sec 57, Sec 322

STEEL							SCHEDULE								
MARK	SIZE	QUANTITY	LENGTH	TYPE	D	C	TOTAL LENGTH	MARK	SIZE	QUANTITY	LENGTH	TYPE	D	C	TOTAL LENGTH
B1	6	12	10-6	1	-	-	126-0								
B2	6	11	10-6	1	-	-	115-6								
B3	7	30	7-10	21	3-5	4-5	235-0								
B4	6	11	10-6	1	-	-	115-6								
B5	6	11	10-6	1	-	-	115-6								
B6	6	2	4-9	1	-	-	9-6								
B7	5	4	9-5	21	0-11	4-4	21-0								
B8	5	2	7-2	21	0-11	6-8	14-4								
B9	5	20	7-1	21	0-11	6-2	141-8								
B10	5	12	9-8	1	-	-	116-0								
B11	5	2	3-8	1	-	-	7-4								
B12	5	4	9-0	21	3-0	6-0	36-0								
B13	5	2	9-4	21	3-2	6-2	18-8								
B14	5	6	7-6	21	1-4	6-2	45-0								
B15	5	12	7-2	21	1-0	6-2	86-0								
B16	5	4	6-10	21	0-8	6-2	27-4								
B17	5	4	6-8	21	0-6	6-2	26-8								
B18	6	2	2-7	1	-	-	5-2								
B19	5	6	2-3	1	-	-	13-5								
B20	5	2	2-4	1	-	-	4-8								
B21	5	2	3-1	1	-	-	6-2								
B22	7	30	4-4	1	-	-	130-0								
B23	5	4	3-8	1	-	-	14-8								
B24	5	5	2-3	21	0-11	1-4	11-3								
R1	5	8	11-7	1	-	-	32-8								
R2	5	6	11-7	1	-	-	43-6								
R3	5	8	11-7	1	-	-	32-8								
R4	5	8	11-7	1	-	-	32-2								
R5	5	4	9-8	1	-	-	38-8								
R6	5	2	3-8	1	-	-	7-4								
R7	5	8	9-0	21	3-0	6-0	72-0								
R8	5	14	9-8	1	-	-	135-4								
R9	5	8	3-8	1	-	-	29-4								
R10	5	32	9-0	21	3-0	6-0	288-0								
R11	5	6	9-8	1	-	-	58-0								
R12	5	8	3-8	1	-	-	29-4								
R13	5	12	9-0	21	3-0	6-0	180-0								
R14	5	4	6-2	21	3-0	3-2	24-8								
R15	5	2	2-10	1	-	-	5-8								
R16	5	8	3-4	1	-	-	7-8								
R17	5	6	3-4	1	-	-	7-8								
T1	5	8	6-6	1	-	-	32-0								
T2	5	8	9-8	1	-	-	77-4								
T3	5	8	8-9	1	-	-	54-0								
T4	5	6	8-10	1	-	-	53-0								
T5	5	6	8-10	1	-	-	53-0								
T6	5	20	9-0	21	3-0	6-0	180-0								
T7	5	2	5-8	1	-	-	7-4								
T8	5	2	6-8	1	-	-	18-4								
T9	5	2	9-2	1	-	-	18-4								
T10	5	2	11-8	1	-	-	23-4								
T11	5	2	14-2	1	-	-	28-4								
T12	5	2	15-3	1	-	-	31-6								
T13	5	4	7-8	1	-	-	30-8								
T14	5	4	6-5	1	-	-	25-8								
T15	5	4	5-2	1	-	-	20-8								
T16	5	4	3-11	1	-	-	15-8								
T17	5	4	2-9	1	-	-	10-8								
T18	5	4	10-7	19	2-2	8-5	42-4								
T19	5	2	4-8	1	-	-	8-6								
T20	5	2	6-8	1	-	-	13-6								
T21	5	2	9-2	1	-	-	18-4								
T22	5	2	11-6	1	-	-	23-4								
T23	5	2	14-2	1	-	-	28-4								
T24	5	2	15-3	1	-	-	31-6								
T25	5	4	7-8	1	-	-	30-8								
T26	5	4	8-5	1	-	-	35-8								
T27	5	4	5-2	1	-	-	20-8								
T28	5	4	3-11	1	-	-	15-8								
T29	5	4	2-8	1	-	-	10-8								
T30	5	4	10-7	19	2-2	8-5	42-4								
T31	5	2	16-3	1	-	-	37-6								
T32	5	2	16-3	1	-	-	37-6								
T33	4	24	9-8	1	-	-	232-0								
T34	4	2	6-2	1	-	-	12-4								
T35	4	9	16-3	1	-	-	146-3								
T36	4	4	6-7	1	-	-	26-4								
T37	5	2	8-8	21	1-10	0-10	6-4								
T38	5	28	7-7	21	1-10	8-11	217-0								
T39	5	2	8-8	21	1-10	6-8	16-6								
T40	4	4	6-7	1	-	-	26-4								
T41	4	9	16-3	1	-	-	146-3								
T42	5	8	3-1	1	-	-	40-8								
T43	5	8	6-0	21	3-0	3-0	48-0								
T44	5	8	4-10	1	-	-	38-8								
T45	5	8	2-8	1	-	-	21-4								

AS BUILT

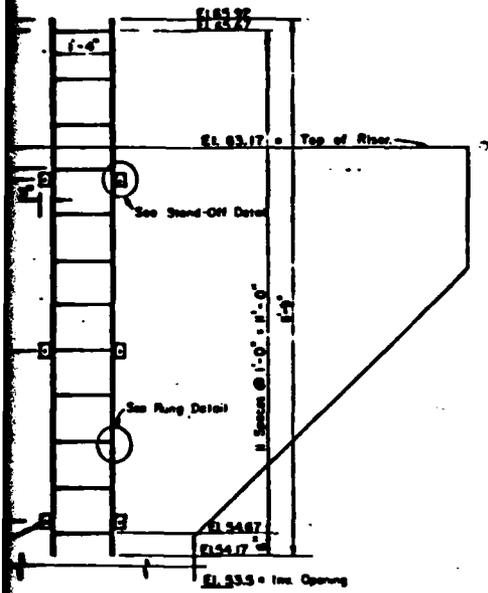
QUANTITIES
STEEL
 #4 BARS - 589-6 - 394 LBS
 #5 BARS - 3421-3 - 3568 LBS
 #6 BARS - 482-0 - 724 LBS
 #7 BARS - 365-0 - 746 LBS
 3432 LBS
CONCRETE = 32.1 + 0.85V = 33.0 CU. YDS

ST. MARYS RIVER WATERSHED
 ST. MARYS CO., MARYLAND
 SITE I
 RISER STRUCTURAL DETAILS
 U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

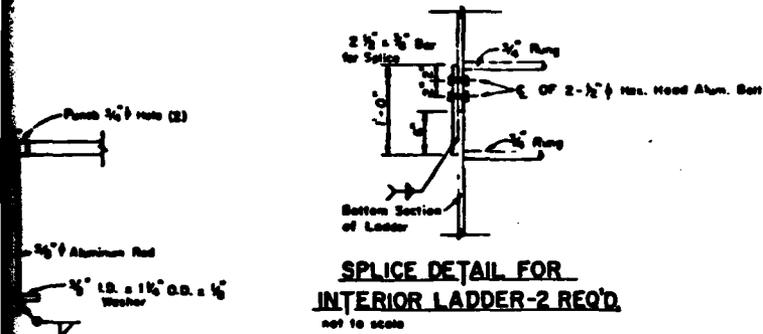
Checked by: A.H. Stahl 5/72
 Approved by: _____
 Date: _____
 Drawn by: A.H. Stahl 5/72
 Date: _____
 Title: _____
 Scale: _____
 No. 10
 23

MD-484-P

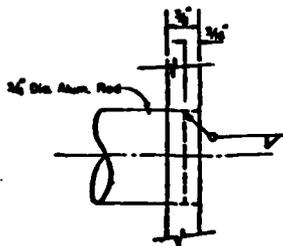
REVISED JAN 1975, MANHOLE CHANGED



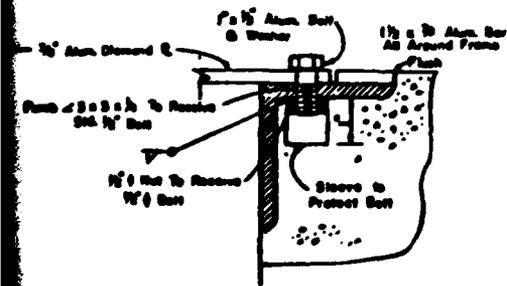
SECTION 1-1
INTERIOR LADDER - 1 REQ'D.
 Scale: 1/2" = 1'-0"



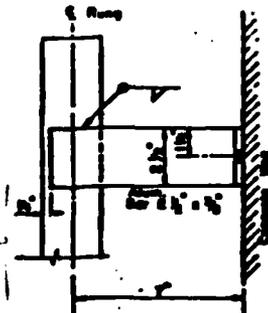
SPLICE DETAIL FOR
INTERIOR LADDER-2 REQ'D.
 not to scale



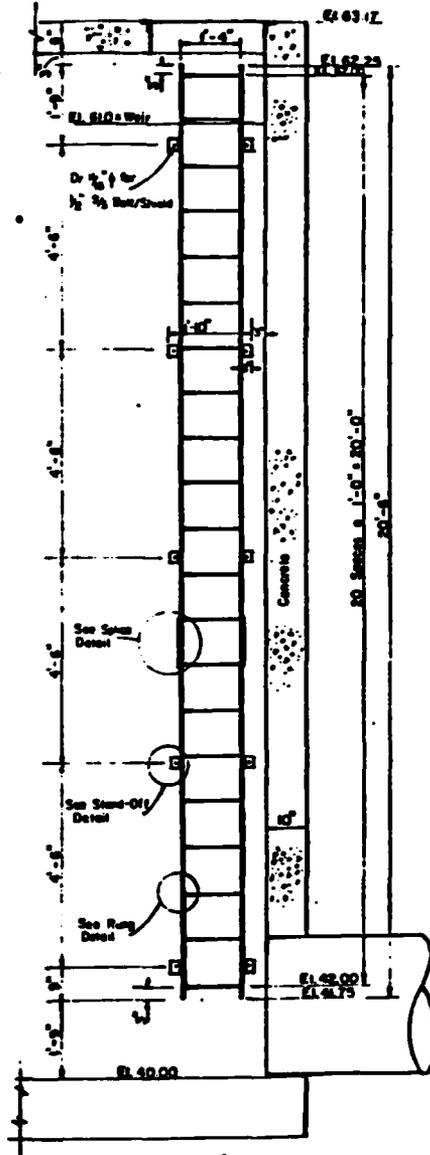
RUNG DETAIL
 not to scale



SECTION B-B
LOCK BOLT - 2 REQ'D.
 not to scale



STAND-OFF DETAIL
 Scale: 1/2" = 1'-0"



SECTION 2-2
INTERIOR LADDER - 1 REQ'D.
 Scale: 1/2" = 1'-0"

AS BUILT

NOTE:
 Alum. Alloy 6063-T6 - Angles, Flat & Plates.
 Anthers - 1/2" x 2 1/2" Expansion Shield

DETAILS FOR LADDERS & HATCH
ST. MARY'S SITE No. 1

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Prepared by	J. A. Rupp	1/78	Approved by	
Drawn by	J. A. Rupp	1/78	Checked by	
Field Notes by	J. A. Rupp	1/78	Project No.	MO 484-P
Scale			Sheet No.	2

APPENDIX F

GEOLOGY

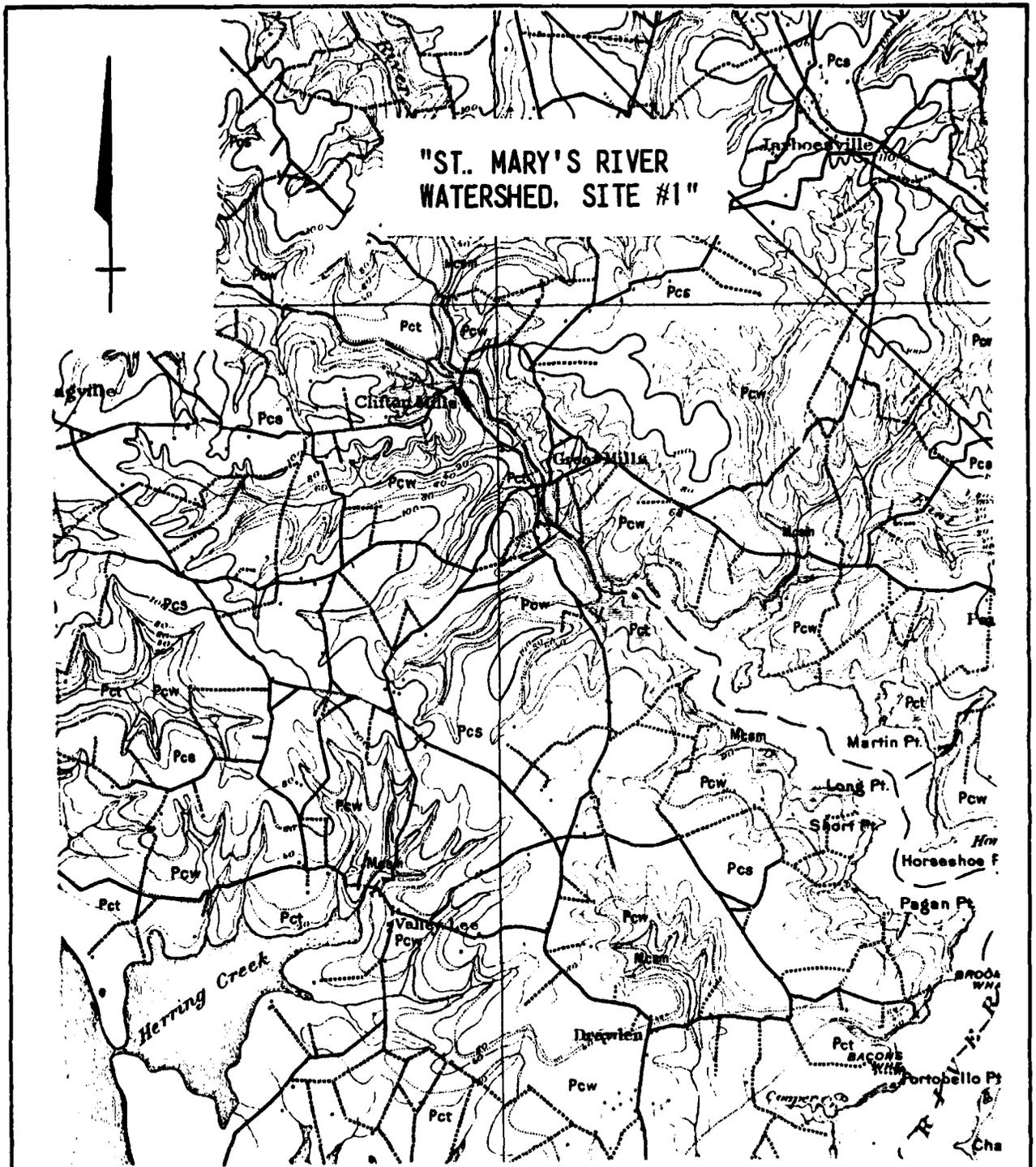
ST. MARY'S RIVER WATERSHED

SITE NO. 1

APPENDIX F

REGIONAL GEOLOGY

The St. Mary's River Watershed, Site No. 1 is situated on the sediments of the Pleistocene Columbia Group, specifically the Wicomico Formation, which include sand, clay, and gravel. Clay from this formation was utilized for impervious borrow for the dam embankment. The average thickness of the Wicomico Formation is 20 feet and the average total thickness of the Columbia Group is 70 feet. The sediments of the Columbia Group lie unconformably on the sediments of the Miocene Chesapeake Group. The dam is located in the Coastal Plain Physiographic Province.



"ST. MARY'S RIVER
WATERSHED, SITE #1"



REFERENCE:
GEOLOGIC MAP OF ST. MARY'S COUNTY
PREPARED BY STATE OF MARYLAND,
MARYLAND GEOLOGICAL SURVEY,
DATED 1903.

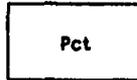
ST. MARY'S WATERSHED

SITE NO. 1

GEOLOGY MAP

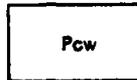
RUMMEL, KLEPPER & KAHL

COLUMBIA GROUP



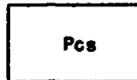
Talbot

*Loam, clay, sand,
gravel, boulders, peat, marl*



Wicomico

*Loam, clay, sand,
gravel, boulders*



Sunderland

*Loam, clay, sand,
gravel, boulders, peat*

PLIOCENE (?)



Lafayette

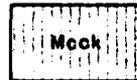
*Loam, clay, sand,
gravel*

MIOCENE



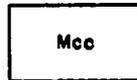
St. Mary's

Clay, sandy-clay, marl



Choptank

Clay, sandy-clay, sand, marl



Calvert

*Clay, sandy-clay, marl,
Diatomaceous earth*

CHESAPEAKE GROUP

REFERENCE:

**GEOLOGIC MAP OF ST. MARY'S COUNTY
PREPARED BY STATE OF MARYLAND,
MARYLAND GEOLOGICAL SURVEY,
DATED 1903.**

ST. MARY'S RIVER WATERSHED

SITE NO. 1

GEOLOGY MAP LEGEND

RUMMEL, KLEPPER & KAHL